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THE AUSTRO-HUNGARIAN MANŒUVRES.

By the "TIMES" MILITARY CORRESPONDENT.

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I.

EXCEPT by means of successful war it is difficult in the extreme for an army to regain its lost prestige. Military failure is, as a rule, ascribed to everything but the right cause. It is by no means unusual to hear the loss of a campaign attributed to national decay, to a general deterioration of physique, or to a universal dislike of discipline. And this opinion is held despite the fact that only a few score years may have elapsed since the nation in question decisively defeated its present conquerors. A few score years, however, are but a short span of a nation's life, and neither nations nor individuals become suddenly worthless. It requires no more than a passing glance at history to tell us that national characteristics are of enduring strength. Misgovernment or misfortune, a succession of incompetent rulers, or a series of crushing defeats may for the time being have debased the national spirit to the lowest level. Revolution, with its long train of disturbance and unrest, may have hindered its development; but, for all that, the nation remains at heart the same. There are those who would have us believe that certain of the great European Powers enjoy at the present moment an undisputed pre-eminence in martial vigour and in aptitude for war. Because, in the recent past, overwhelming defeat has been the lot of once famous armies, we are assured that against the same antagonists defeat will be their inevitable portion in the future. The causes which led to that defeat are entirely ignored, and it is apparently assumed that the conditions of the contest will always be identical. The part played by superior numbers, a more perfect organisation, sounder tactics, and more skilful generalship is altogether overlooked, and success—both that which is past and that which is predicted—is attributed to some inherent superiority on the part of the victors which no efforts on the part of the vanquished can by any possibility reduce. It is a dangerous doctrine. Armies, like that of France in 1870, have been lost because of their blind

faith in tradition. Others have discovered to their cost that their enemy is no longer the old enemy, but one who has found new vigour in the maxim, "*Fas est ab hoste doceri*."

It is doubtless true that an army takes a long time to shake off the evil habits which once sapped its strength. It is just as certain that political conditions exert a marked influence on military efficiency. Discipline, for instance, is probably more difficult to establish amongst the citizens of a republic than amongst the subjects of a despot. But the discipline of the serf is scarcely a match for the more ardent courage of the free man, and it has yet to be proved that the old English adage which tells us that "one volunteer is equal to three pressed men" has lost its force. Political conditions may thus have an ill effect in some respects, but may produce results in others which will be found a more than sufficient compensation. Nor should it be forgotten that armies are susceptible of rapid improvement. If the material in the ranks be good, and the spirit of patriotism high, hard work and a wise chief will soon revive energy and restore efficiency. At the close of the eighteenth century, probably no army in Europe had a more indifferent reputation than our own. Before fifteen years had passed it was confessedly unsurpassed. So swift a transformation is not without parallels in history, and it is idle to assert that it is unlikely in the future. "If there be," wrote a great historian, "as perhaps there are, some physical and moral qualities enjoyed by some nations in a greater degree than others, and this, so far as we can see, constitutionally, yet the superiority is not so great but that a little over-presumption and carelessness on the one side, or a little increased activity and more careful discipline on the other, and, still more, any remarkable individual genius in the generals or the government, may easily restore the balance, or even turn it the other way."

Over the eagles of Austria hangs the shadow of a great defeat. Her struggle with Prussia culminated in ruin, which was little less complete than that of her sister Empire. Von Moltke's stroke was even swifter and heavier in 1866 than 1870, and, had not political consideration stayed his hand, Vienna would have fallen a far easier prey than Paris. Nor can Austria show so long a record of previous victories as France. She has been doubly unfortunate. Not only has she had to contend in succession with the three ablest leaders of modern times—Frederick, Napoleon, and Von Moltke—but her own most brilliant soldier, the Archduke Charles, was pitted against the greatest of them all. Still, with all her ill-luck, she has vindicated her title to be regarded as a great and warlike nation. Her desperate struggle with Napoleon proved the mettle of her armies; while the long tale of defeats inflicted on the French Marshals when Napoleon himself was absent, prove how much France owed to his individual ability. The fierce fighting of Wagram, where the numbers were almost equal, and yet for two long days victory hung in the balance, showed that, even with the genius of Napoleon thrown into the scale, the military efficiency of the Austrian soldiery was scarcely outweighed by that of the French. In 1859, handicapped as they were by their own generals, victory only just escaped them at

Solferino, and in 1866 the disasters in the north were set off by the brilliant victory of Custozza in the south. It is difficult to gainsay the opinion of a well-known writer that no army in Europe has ever owed less to fortune than the Austrian. The right man has seldom been forthcoming at the right time; a constant succession of wars and revolts has interfered with the progress of reform; and the political exigencies of the dual Monarchy still render impracticable the German simplicity of organisation. Nevertheless, despite the most unfavourable conditions, the army of Austria has always done its duty. As I have already suggested, it has had its fair share of success. If its services have not been invariably brilliant, it has generally sustained its *moral*, even in adverse circumstances; and where one arm has altogether failed, the conduct of the others has redeemed the character of the whole. Never has this characteristic been more conspicuous than in 1866. Not only is Custozza to be set off against Sadowa, but the splendid bearing of both the artillery and cavalry, in Bohemia, as well as in Italy, made it abundantly clear that defeat was by no means to be attributed to the deficiencies of the regimental officers and men. In the Bohemian campaign it was the commander and the staff who were at fault.

Benedek accepted his appointment with the remark that he knew nothing of strategy, and he was opposed by the greatest strategist of the age. From the very outset he was out-generalled by Von Moltke. Nor were his staff officers a match for the subordinates whom Von Moltke himself had trained. It is true that the famous needle-gun played no small part in the Prussian victories. It may be said to have increased the tactical power of the infantry, already numerically equal to their adversaries by at least 25 per cent. But, even had the armament on both sides been identical, Von Moltke's generalship, backed by the thorough training of the Prussian army, must still have triumphed. The blunders of the Austrian leader, the blunders of his staff, the blunders of his lieutenants, must always have rendered unavailing the valour of his troops.

These historical reminiscences may perhaps appear beside the mark. But the great manœuvres of the Continental Powers are something more than object-lessons in tactics. They are not merely tests of improved material or new formations, but they afford a clue, imperfect though it be, to the efficiency of the armies and to their relative weight as political factors. The knowledge that their last appearance in the field was attended by defeat is by no means unlikely to produce a false impression. For this reason I have thought it useful to refer to the services of the Austrian army, and to recall the causes which led to the disasters of 1866. If, on reviewing the manœuvres of 1894, it is found that the radical defects which formerly existed have been corrected, and that the good qualities of the troops are now allowed free play, it will be possible to form a just estimate of the part that the nation may be expected to play in any future complications.

It is not only, however, as a political factor that the army of Austria-Hungary is worthy of consideration. Within the last five-and-twenty years it has been thoroughly reformed. But reform, while moving in the

same direction as elsewhere, has not been altogether an imitative process. The organisation of the army has certain features peculiar to itself. Some of these have been dictated by political exigencies, some by considerations of economy; but there are others which are of native origin, due to the initiative of the staff, and owing nothing to the universal model supplied by Germany. These, I venture to think, are full of interest.

1893 saw army manœuvres attempted on a scale unprecedented in the Empire. Five army corps and two cavalry divisions, a total of 165 battalions and infantry, 97 squadrons, and 300 guns, were assembled for six days, and the operations proved an unqualified success. In 1894 the exercises were less ambitious. Early in September the 1st and 9th Austrian Corps manœuvred against each other on the Bohemian border, and a week later the 4th and 6th Hungarian Corps met in opposition north of Budapest. In consequence of the cholera the proposed cavalry manœuvres in Galicia were abandoned; but, in addition to the four *corps d'armée* above mentioned, operating under the immediate supervision of the Emperor and the Commander-in-Chief, the remaining eleven were exercised individually under their own generals. The Imperial manœuvres, moreover, included four divisions of Landwehr infantry and several regiments of Landwehr cavalry, or a total of sixty battalions and more than twenty squadrons of troops of the second line. In addition, the Regular battalions were reinforced by a number of Reservists. A very large proportion, therefore, of the Austrian Army has been trained to field-work on an extended scale during the autumn of 1894, and I may bring to notice that this is no abnormal effort, but merely a phase of the ordinary routine. Battle-exercises, as in Germany and France, are as constant an element in the training of the troops as drill, musketry, or marching. The soldier is taught what it is to form a unit in an army corps in just the same way as he is taught what it is to form a unit in a squadron or company. Whether such knowledge is necessary for the private in the ranks admits, perhaps, of argument. There can be little doubt, however, but that it is beneficial to the regimental officers, and no question whatever that experience in handling masses is absolutely essential to the higher commanders and the staff.

It is self-evident that the difficulty of command increases with the strength of the force to be controlled. But it is not always recognised how great this difficulty becomes. *The Times* Correspondent with the Aldershot flying columns discussed, on August 29th, the object and purpose of autumn manœuvres, and to justify his arguments quoted from the volumes on Staff Duties by General Bronsart von Schellendorf. I may perhaps be permitted to bring forward more familiar names. "With small bodies of 10,000 men," wrote Sir Charles Napier, "we English generals do pretty well, but I do not believe we have a living general that could wield 100,000, except the Duke of Wellington, and perhaps Lord Seaton and my brother. We have *no practice*." (italics in original). "The Duke is the only one among us who has ability and practice united, but he is a phenomenon. My observation applies to ordinary English

generals, and, to tell the truth, I do not think Continental generals a bit better!" Sir Hope Grant, also, a soldier of scarcely less experience, in criticising the mistakes make at the Wiltshire manœuvres of 1872, when 30,000 men were assembled, noted in his journal that "general officers cannot be expected to move large bodies of men without experience."

Those who have attended the great Continental manœuvres will certainly corroborate this opinion. They will remember that when, fresh from the operations of English brigades and flying columns, they attempted to follow the movements of larger masses, they found it difficult in the extreme to realise the extent of country covered by the troops, the length of the opposing fronts, and the wide scope of the turning movements. The engagements appeared to them a series of isolated combats of divisions or brigades, and they failed either to detect or to follow the tactical combinations of the generals in chief. In fact, until they had had some practice, their "focus" was altogether too small. In handling troops, as in dealing with ground, habit is everything; and in time of peace the habit of handling masses, so essential to both generals and staff, can be acquired only in manœuvres on an extended scale. I may here remind my military readers that both in France and in Austria the numbers requisite to form a large force have been obtained by combining all the troops engaged, and employing them as an independent army against a "skeleton enemy." By means of such exercises the art of commanding large bodies may be learned without extra burden on the exchequer, and the true purpose of extended manœuvres—*i.e.*, the training of the higher leaders and their assistants—may be most easily achieved.

II.

Northern Hungary, in mid-September, is certainly an ideal country for manœuvres. The broad plains and rolling hills form an admirable field for the operations of all arms. The climate, too, before the autumn rains set in, is nearly perfect. It is the exact counterpart of the Indian "cold weather." Bright warm days are succeeded by cold nights, and the bracing air of the early morning, crisp with a touch of frost, makes marching, even to the heavy-laden infantry, more of a pleasure than a toil. Nor do cloudless skies alone recall the East. The brown and arid levels, stretching away into blue distance or met by ridges of low hills as brown and arid as themselves, the scattered clumps of trees, the dusty woods, the isolated and compact villages, and the long ravines, cut deep by the heavy rains, scarcely need the brilliant sunshine to suggest a comparison with "the plains." The familiar aspect, however, of the natural features is not the only attraction to an Englishman. Not only does he "hear the East a-calling" when he reaches the Hungarian border, but in the people themselves he finds characteristics which appeal strongly to his instincts. Nowhere in Europe are the claims of sport regarded with more veneration than in the Dual Monarchy. Nowhere are to be found finer horsemen or more enthusiastic "shikarries." Every country town has its racecourse, every farm a gun behind the door, and every country

gentleman drives his four-in-hand. Such similarity of tastes is a strong bond of mutual interest, and produces, in many respects, an identity of habit and of mode of life which soon effaces all sense of strangeness. As regards the officers, at least, the Austro-Hungarian Army resembles our own more than any other in Europe; and Englishmen find themselves at home far more rapidly than elsewhere. In the ranks, conscription, drawing all classes into its insatiable maw, brings about a difference; but, nevertheless, the sporting proclivities of Mr. Atkins are just as marked in his Hungarian *confrère*. It is an historical fact that in the Secession War, a carefully-planned surprise was completely frustrated by a fox breaking covert in front of a Confederate battalion. The yell which greeted his appearance warned the unsuspecting Federals of their danger; and so, in the Hungarian manœuvres, the flight of a frightened hare was always sure to excite an irrepressible commotion in the otherwise silent ranks. To those who hold that men of sporting instincts and accustomed to an open air life are the best material for an army, it would seem that the Hungarian troops are not likely to be behind when it comes to hard fighting. Moreover, judging not only from the peasantry in the manœuvre area, but from the long political struggle from which they have so lately emerged successful, the spirit of the Hungarian people is of that stubborn and independent character which makes its mark in war. Nor are their physical qualities in any way deficient. The country folk are sturdy, healthy, and hard-working. The stock is sound, and the conscripts supplied by the agricultural population, if somewhat short of inches, are hardy and enduring. As large cities are far between, and manufactures few, the country side furnishes the larger portion of the annual levy, and the town-bred element is too small to reduce the general average of bone and muscle. It must be remembered that in speaking of the Hungarian troops I am not speaking of the whole Austrian Army. So numerous are the races under the dominion of the Emperor that no fewer than eleven different languages are officially recognised. Words of command are always given in German, but these words, as a rule, are the only German that three-fourths of the rank and file understand, and all other intercourse between officers and men is in the language of the province in which the regiment is recruited. Communication between the troops of different districts is thus limited in the extreme, and the want of a common medium might have most serious results in war. Each of these eleven languages represents a distinct race, but, speaking generally, the army may be said to be composed of Germans, Slavs, and Hungarians, the latter supplying six of the 15½ army corps. I am assured, however, by very high authority, that although the various races of the Empire are distinct in character, yet training, discipline, and, above all, leading, are so uniform throughout, that in all essential particulars one army corps is the counterpart of another.

Between the troops of the two great divisions of the Empire, Austria and Hungary, a distinction exists both in the cavalry and infantry in point of uniform. As regards the first, the Austrian cavalry are dragoons, the Hungarian are hussars. The dragoons wear the helmet, the hussars

a light shako, of the regimental colour, with a straight black plume. Otherwise there is not much difference. Both wear the blue tunic with scarlet overalls, and both the furred dolman slung over the left shoulder. The infantry also have the blue tunic; but the Hungarians wear tight pantaloons of a lighter blue, instead of the ordinary trousers and gaiters. The rifles, of whom there are forty-two battalions, wear gray, with grass-green facings instead of blue, and it was most marked at the manœuvres how much less conspicuous the Jägers were than any other troops. Both cavalry and linesmen stood out in dark relief on the brown fields under the bright sun; the masses of infantry, with the dark and light blue blending, looked like great patches of cornflowers on the bare hillsides. The riflemen, on the other hand, were long before they caught the eye, even when in compact bodies; whilst their patrols and scouts, despite the absence of cover, were often altogether unobserved. And yet, if anything, when off duty, and especially in full dress, the rifleman is the smarter of the two. The advantages of "khaki," as a campaigning kit, were thus most forcibly illustrated.

It is not without a purpose that I have referred to the Hungarian uniforms. No description of manœuvres is complete unless the reader has some idea of the targets presented by the troops, and with the question of targets uniform has much to do. The picture, too, of the operations will be clearer if his imagination grasps both the character of the country and the appearance of the men.

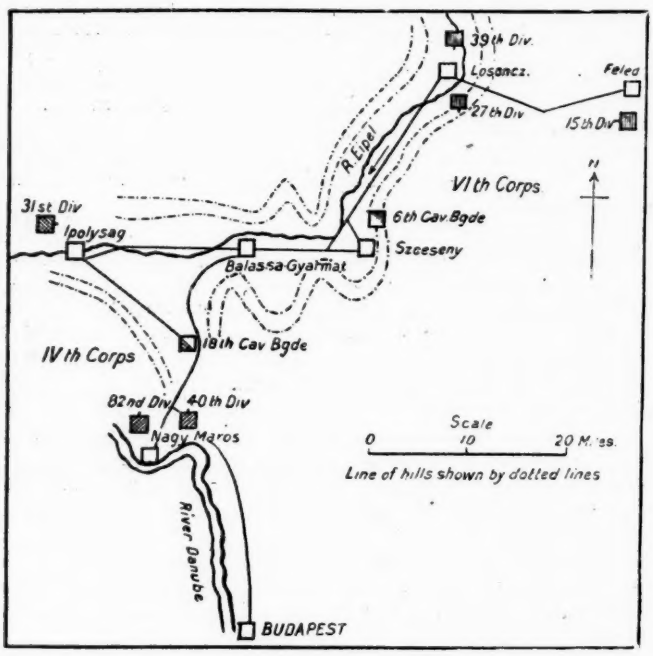
The area of operations selected for the manœuvres was of wide extent. Hostilities began on Monday, September 17th, on which day the 4th Army Corps and the 18th Cavalry Brigade, a force of forty-three battalions, 21¾ squadrons, and seventy-four guns, crossed the great angle of the Danube at Nagy Maros, some twenty miles north of Budapest. On the same morning the 6th Army Corps, numbering forty-one battalions, twenty-one squadrons, and seventy-four guns, marched southwards from a line some seventy to eighty miles, as the crow flies, north-east of Nagy Maros. Of the breadth of the area occupied the limits were less definite. I should put it down, at a rough calculation, as eighty miles, a space amply large enough for both reconnaissance and manœuvring, especially as, with the exception of vineyards and plantations, which are very few, there was no "prohibited" ground whatever.

The General Idea assigned an offensive *rôle* to both corps; the 6th acting as the right wing of an army marching against Budapest from the north-east, the fourth as the left wing of an army moving against the invader from the Danube.

On September 18th both corps, covered by their cavalry brigades, moved rapidly forward, both making for Balassa-Gyarmat, a small town on the river Eipel, in the mouth of the long defile through which the great chaussée from the north-east runs, and therefore of great strategic importance to either side. The cavalry brigades, each assisted by a battalion of infantry, met early in the morning near Balassa, and retired to their quarters after an engagement which was pronounced indecisive

by the umpires. During the day the infantry closed up, the Southern force marching on an average fifteen miles, and the Northerners twenty-five. The advantage so far lay with the Southern force. The general commanding had his three corps concentrated west of Balassa-Gyarmat, effectually blocking the exit from the defile. It was impossible for the Northern commander to have anticipated this occupation; but his movements also were based on sound strategy and a correct appreciation of the ground.

The problems before him were by no means easy of solution. In the first place, when he broke up from his bivouacs in the early morning, his force was very far from being concentrated. In order to introduce a



difficult element into the situation, the director of the manœuvres had distributed the troops, before the operations began, so that a division on each side—that is, one-third of the force—was detached at a distance of twenty miles from the main body. The concentration of the Southern force had been comparatively simple, for both the detached wing and the main body followed good roads converging on Balassa-Gyarmat. The Northerners, on the other hand, were far less favoured. The long Eipel defile had to be traversed, and the detached wing had to follow the same route as the main body. The first thing then to do was to find a position in which the whole force could be concentrated. Such a

position, fortunately, existed some three miles east of Balassa-Gyarmat. At this point, where the broad and level valleys of two tributary streams join the valley of the Eipel, the defile opens out to north and south, and the ridges to the east form an exceedingly strong position, with a wide view and a fine field of fire. Moreover, behind the crest an open plateau stretches back for several miles, with room on its unbroken surface for the deployment of a large army. It was to seize this position, where he could await in comparative security the arrival of his rear division, that the Northern general had exacted from his troops a march of five-and-twenty miles. It may be noticed also that from this position, if he were able, after his concentration, to assume the offensive, it would be easy to at least threaten his enemy's line of retreat on Budapest, for the hills south of Balassa are passable at several points by both infantry and guns.

The next morning (September 18) the Southern general determined to attack. His cavalry had reported that two divisions only were present on the heights east of Balassa, and it was clearly to his interest to deal with his adversary whilst the latter was much inferior in both men and guns. Moreover, as the imaginary army, of which he formed a detached wing, was known to be moving forward with the purpose of taking the offensive, it was manifestly his duty to draw on himself as large a portion of the hostile force as possible. If he stood still the troops before him might either move off to reinforce the invading army, or might manœuvre so as to intervene between him and his own main army.

The attack was long in developing. Before six a.m. the cavalry was active all along the front; but it was exceedingly difficult to discover the strength of the defending force, concealed as it was behind the crest of the formidable heights, in some places densely wooded, and the Southern commander soon found it necessary to send forward a body of infantry, under cover of artillery fire, to make a reconnaissance in force. This expedient, although the troops engaged were very roughly treated, seems to have had the desired effect, for shortly before eight o'clock a heavy artillery fire opened all along the line. Meanwhile the infantry formed for attack, and the left Southern division, moving north of the Eipel, prepared to cross that river higher up, and to come down on the right flank of the defence, which was posted south of the Balassa road.

I have already said that the artillery duel began at eight a.m.; and it may be noticed that it was not till more than two hours later that the infantry attack began. It is, perhaps, even more noteworthy still that for these two hours, or, at all events, after the reconnaissance in force had been completed, scarcely an infantry soldier was to be seen on either side. The cavalry patrols held the field alone.

The attack, when it was at length developed, was made in no piecemeal fashion. A brigade and the artillery held the enemy in front. A division, reinforced by a brigade, assailed his left flank, on which a very heavy artillery fire had long been concentrated; whilst the third division, crossing the Eipel, struck him in the flank. Several circumstances,

however, militated against success. In the first place, the defender's left was naturally strong and had been intrenched before daybreak; secondly, owing to a large wood in front of his right, it was impracticable either to prepare or to assist the flank attack from beyond the Eipel by artillery fire from the front—*i.e.*, when his right flank was thrown back to meet the turning movement, it was secured by the wood from enfilade. But, worst of all, the Southern cavalry had been unable to discover the whereabouts of the third division of the Northern army. It was known on the morning of the engagement that this division was missing; but this was all. It was suspected, however, that it was moving down the defile in rear of the others, and the left division of the attack had been sent north of the Eipel in order to block its way. Its march, however, was easily hidden in the hilly country to the north, more especially as nearly the whole of the Northern cavalry was held back with the purpose of screening its approach. Its intervention in the battle was a surprise to others besides the attacking troops. Those who shared the information of the umpire staff knew that its bivouacs of the previous night were three-and-twenty miles from the field of action, whilst the heat was great and the dust thick and stifling, and the men carry, including their rifles and ammunition, nearly sixty pounds of kit. When, about 10.30, the infantry attack developed in such overwhelming strength, it seemed certain that the defence must be broken through. But soon after 11 a.m. a line of guns, far away to the right rear, belonging to the missing division, came into action against the flank of the Southern division, which was attacking from across the Eipel, and, at the very crisis of the battle, the outflanking force was itself struck heavily in flank. So strong was the counter-stroke, and so rapid the advance of the battalions that made it, notwithstanding their long and exhausting march, that the left wing of the attack would have probably been rolled up in confusion had not the Southern cavalry brigade, dashing forward to cover the retreat, driven in the hostile horsemen, and for a few precious minutes checked the pursuing infantry. At almost the same moment the grand attack on the opposite flank was also driven back, and at twelve o'clock, in consideration of the heavy work done by the 6th Corps in the way of marching, the Emperor ordered "Cease fire" to be sounded. A line of demarcation was drawn by the umpires between the rival forces, and the troops marched off to their billets. The billets may be said to have been the reward of victory, and a reward by no means to be despised. Had the 6th Corps been defeated it would have had to withdraw to the eastward and find shelter in villages not less than eight or ten miles distant. As it was, the 4th Corps had to return to their billets of the previous night, and these were at least that distance to the rear.

On the 20th, the invading commander, having completed his concentration and repulsed the enemy, determined to complete his victory by attacking the latter on the ridge south of Balassa-Gyarmat, cutting his communications, and driving him towards the north. At a very early hour the advance began. The cavalry patrols, however, had

detected the movement from the very outset, and long before 5 a.m. the Southern troops were marching out to occupy the position. This position was almost as strong as that which they themselves had vainly attacked on the previous day. The ridge commanded the open plain; nearly every movement of the enemy was therefore within view, and even where he managed to hide his march in the depressions of the ground, the heavy clouds of dust betrayed not only the presence of his troops, but the strength of the column and the direction of its march. A line of woodland, too, on the lower slope of the hills screened the dispositions of the defence.

The Northern commander's plan of attack was to hold the enemy with his right and centre whilst his left division turned the inner flank. With this purpose in view the troops were distributed as follows :—Right wing, one brigade; centre, one division; left wing, one division; cavalry on the extreme right; and one brigade as general reserve in rear of the centre. With regard to this day's operations it is sufficient to say that the attack altogether failed. The artillery duel began at 7.25, and at 8.50 the infantry advanced. On the preceding day the exact combination of the different attacks had been a most noticeable feature of the day's operations. On the 20th, however, the opposite was the case, and here again the division engaged in turning the flank of the defence was itself surprised and outflanked. Moreover, the brigade on the right, advancing unsupported, was crushed by a sudden counter-stroke made by a whole division, most ably assisted by the 18th Cavalry Brigade. During this time the centre division had done nothing beyond developing a thin firing line, and the defender had thus been able to deal with the two wings at his leisure, massing against both of them in superior strength. In so doing, however, he had left his centre very weak, and had the Northern division opposite that point pushed vigorously forward, in combination with the attack of the two wings, it is very possible that the defender's line would have been broken through. This division, however, had to cover a wide extent of front, and I doubt whether it could have been massed opposite the weak point before the wings had been defeated. The fact of the attack having been planned, and the troops having been given their objectives, the night before—*i.e.*, before the dispositions made by the defence could have been known—was probably responsible for the defeat. The position occupied by the division which rolled up the turning movement was certainly unexpected, and remained undiscovered until it was too late to rectify the general plan. But had the attacking army corps been held in hand until the ground had been thoroughly reconnoitred, the defender would possibly have suffered for the over-extension of his troops. In my humble judgment premature deployment was the fault on both sides, nor can I believe that a force of 25,000 men should, in ordinary circumstances, be called upon to cover a front so large as four or five miles. Less than 150 miles north-west of Balassa-Gyarmat lies a battlefield where this very fault, committed by a Russian general, led to one of the most dramatic catastrophes in the records of modern war. At Austerlitz, the front covered by the

allies, when their attack developed, was more than seven miles in length. With what tremendous energy Napoleon threw more than half his army against their feeble centre, breaking the line in two and involving the whole of the hostile battle in irredeemable confusion, I need scarcely here recall. As regards the defence it is true that in a very open country, where the direction of the attacking columns can be seen from afar, an extension wider than under ordinary conditions is permissible. The commander, in such circumstances, receives long warning of his enemy's intentions, and has ample time to move his reserves to the threatened point. This in all probability was the idea of the defending general in the engagement I have just described.

The pursuit after the repulse was not continued far. The 6th Corps, under cover of its reserve, withdrew rapidly to the line of hills from which it had advanced, and shortly after twelve o'clock, just as the defender was, in his turn, preparing to attack, the action ceased. The last day of the manœuvres, September 21st, was not the least instructive. The invader had now been decisively defeated, and was compelled to fall back on Losoncz through the Eipel defile. This was by no means an easy operation, for the wagon train which accompanied the troops had first to be got away. The train marched at daybreak. At 8 a.m. three infantry brigades followed, leaving three infantry brigades, with the artillery and cavalry, as rear-guard. The position on which the rear-guard drew up to cover the withdrawal was very skilfully selected. The right wing, posted on an almost inaccessible bluff, commanded the country to front and flank for more than two miles, whilst the remainder of the line ran within the hills, which at this particular point are broken into a series of tortuous ridges, 200 or 300 feet high, divided by narrow gorges, and very steep.

The day's work was exceedingly interesting, but, owing to the intricate nature of the country, impossible to describe. The artillery duel, between two great masses of artillery, began at 7.45. At 9.40 the attacking infantry, which had been compelled to change front, pivoting on its left, in the hilly country, struck the extrême left of the defender's line. Forty minutes later the battle became general, and heavy masses pressed forward at every point. At 11 a.m., when the attacking infantry had got within 700 yards of the position, and the second line had already reinforced the firing line, the "Cease fire" sounded. The defender claimed—and, I think, rightly—to have secured his retreat. The very difficult and tiring country over which he had compelled his opponent to move had certainly made his task a comparatively easy one. I may add that a movement against the extreme left of the rear-guard was frustrated by three squadrons of cavalry, who managed to surprise the troops engaged in working round the flank. It was certainly most unexpected to find cavalry acting offensively in such hilly ground, but it is a very bad country indeed that will stop either the Hungarian hussars or the Hungarian gunners. No sooner had the "Cease fire" sounded than the troops moved off to their last bivouacs before entraining, and as proof of what is expected from their powers of marching it may be mentioned that many of these bivouacs were from twelve to twenty miles distant from the battlefield.

The four engagements, including the cavalry fight on September 18th, took place in a somewhat confined area. The great plain south of Balassa was traversed over and over again by the troops of either side; but, nevertheless, each position occupied was distinct in character. Nor was the space over which the operations took place so contracted as to detract from their realism. An area of twenty miles by fifteen gives ample room for large tactical combinations. It will have been remarked that as soon as the two armies came into contact the generals elected to settle their differences by hard fighting. The one took up a defensive position, and the other attacked him. There was no exposition of that branch of generalship which is expressed by the term "manœuvring." The attacks were comparatively simple operations, and no attempt was made, on any one of the three days, to turn the positions, and thus compel the enemy to change front and to fight on ground which he had not prepared for defence. Such an operation was by no means impossible of execution. Either force, on any one of the three days, might have worked round by the flank. This omission, however, is not to be considered as a fault on the part of the commanders. The three days, I take it, were set apart to give practice to the generals and the staff in handling troops upon the field of battle, and to the troops of working in large masses. It would be exceedingly instructive if both strategy and "manœuvring" could be practised in the same way as minor tactics. But the enormous expense of assembling large bodies of men for any other purpose than that of training in battle exercises stands in the way, and both strategy and manœuvring can be taught theoretically almost as well as when troops are present. The one thing necessary is that they should be taught on the ground and not in the class-room alone. The "staff journeys," common to all European armies, provide for the education of staff officers in this respect, and in Austria, as well as in Germany, and, I believe, in France, a large number of officers other than those who have passed through the staff colleges are trained by this process in these important branches of the military art. A supply of competent leaders is thus secured.

III.

Although ample space may be available and several divisions may be assembled, unless the most careful and systematic arrangements are made beforehand, the instruction gained from the larger manœuvres may be by no means commensurate with the expense. It may be remarked then, in the first place, that the troops which took part in the Imperial manœuvres were complete in nearly everything which makes an army mobile. The commissariat was so managed that the generals had a free hand. They were independent of standing camps or standing supply depôts. The troops were quartered in accordance with the actual situation—that is, at the end of each battle, or each day's march, the staff of either army distributed the units in the locality to which the day's operations had brought them. The whole country-side, without any limitations, being placed at the disposal of the armies, the difficulty of

finding shelter was got over by either billeting the troops in villages and farms or, in case such accommodation was not to be found, by ordering them to bivouac. The cavalry bivouacs were generally *à la belle étoile*. Officers and men have to rough it altogether, and one of the former told me that he had to sleep for five nights running on the bare ground. The infantry soldier, on the other hand, carries a section of *tente d'abri*, made of brown waterproof, and with a supply of straw a comfortable camp can rapidly be constructed. Supplies followed the troops in country wagons requisitioned for the manœuvres, and herds of cattle had been collected at various points. Each man also carried a three days' supply of preserved provisions, soup, coffee, and biscuit, and the ration of fresh meat and rye bread was always issued. If service conditions are strictly adhered to it cannot be known in the morning where the troops will find quarters at night. A certain amount of hardship is thus entailed upon the men. The supply wagons cannot follow the troops whilst fighting is going on, and it may be late in the evening before they can be brought up and rations issued. Late dinners, especially where the midday meal has been omitted, are not altogether to the taste of the rank and file. But in war late dinners are the normal experience, except when they are postponed to the next day, and a practice is hardly to be condemned which gives both officers and men a practical insight into the trials of active service. Soldiers who have been over-coddled in peace will probably grumble over much when they take the field at Aldershot. It appears, at all events, that there is nothing like habit to inure men to rough work. The Hungarian soldiers made very light of their impromptu encampments or the late issue of their food. Not only was there no grumbling, but the longest march appeared to have no effect in making the bivouacs less cheerful.

It is not, however, by the mobility of the rival forces being thus secured that an approximation to service conditions is attained. War is something more than a matter of marching, camping, and supply. It is not sufficient, if the manœuvres are to be realistic, that the generals should be able to move their troops in whatever direction they please, and to execute such combinations as may appear necessary, regardless of "the men's dinners" and the officers' mess. Realism, so far as is possible when no bullets are flying, must be carried into the fight itself, into the skirmishes of patrols and outposts, as well as into the collision of the lines of battle. If men are allowed, in their peace training, to do what would be suicide in war, to execute manœuvres impracticable under fire, to move in vulnerable formations, to disregard cover, and to ignore the possible effects of shot and shell, the habits thus ingrained will assert themselves with fatal effect on actual service. Both generals and men must be taught, and taught on the spot, what their mistakes are. This is effected by means of the umpires, officers detailed to estimate the effect of the enemy's fire, and to check the advance, or to order a retreat, when, in their opinion, had bullets been flying, one side or the other would have got the upper hand. The work of instruction, then, the chief end of the manœuvres, is almost altogether in the hands of the

umpire staff. The chief umpire, naturally, criticises the combinations of the army commanders, and determines the general result of the operations. But all details are left to his assistants; and their judgment, given on the spot, decides the success or failure of every movement, enables their chief to arrive at a correct conclusion, and at the same time exposes the errors of the subordinate commanders. I may say at once that I have never seen better umpiring than in Hungary. Decisions were promptly given. The effect of fire was duly appreciated, and troops in unsuitable formations were at once sent to the right-about. The result was that the battles were both realistic and instructive, especially the great attacks. At one point the long blue lines are seen rapidly pressing forward over the open ground; at another they are checked at 600 or 700 yards from the defence, unable to attain that superiority of fire which will alone enable them to continue the advance; at another they are retreating, seeking the cover whence they emerged. Here are the cavalry swarming round a battery, and the limbers coming up to carry to the rear the guns which have already been adjudged discomfited. No hesitation anywhere visible, no blunder suffered to escape unchecked, and no want of prompt acquiescence on the part of the troops. Such excellent work as this is the result of a sound and well-thought-out system, and it is worth a detailed description. The umpire staff, in the first place, is ample; in the second, it is carefully selected; and, in the third, it includes many well-trained officers of superior rank. The Commander-in-Chief, the Archduke Albert, the hero of Custozza, acts as chief umpire, assisted by General von Beck, the well-known Chief of the General Staff. As their assistants in Hungary no fewer than forty-three officers were detailed, including six lieutenant-generals, ten major-generals, and nine colonels and lieutenant-colonels. The remaining officers, with scarcely an exception, have passed through the Staff College, and hold appointments on the General Staff. The whole of these forty-three, however, are not called upon to give decisions. To each umpire is attached an assistant, and the duty of these assistants is to act as gallopers, reporting to the umpires in other parts of the field the decisions given by the officer to whom they are attached, keeping the umpires in close communication with each other, conveying orders, and seeing that they are carried out. Umpires are detailed to accompany each important unit, to ride with the reconnoitring parties, or to supervise a defined section of the defence. Their reports, as well as those of their gallopers, which, when put together, form a complete narrative of the action, are forwarded to the chief umpire, and every single manœuvre can thus be minutely criticised. The result of the criticism is made known after the manœuvres. No "critique" of each day's operations follows the "Cease fire." Such conferences are confined to the smaller manœuvres. The Imperial manœuvres, having as their object the training of the higher leaders and the staff, are not discussed *coram publico*, but at the War Office in Vienna, on the day after operations have ceased, and the generals, staff officers, and umpires alone attend.

However efficient any branch of the service may be, its powers will

be wasted if it does not work in harmony with the others. Battles are not won by magnificent charges or even by accurate fire; but by infantry, artillery, and cavalry, mutually supporting one another, expending their best endeavours to attain a common object, and thinking of others first and themselves last. The officer who looks at war in relation to his own arm alone, and who is not ready at all times to play a subordinate *rôle*, and to sacrifice, if necessary, himself and his men in order that others may reap the reward of victory, may be a dashing fighter but he is no real soldier. To combine his whole force in a single effort is the task of the commander. But the subordinate leaders have their part to play. Unless the smaller units work in unison, friction and confusion will be the inevitable result. The cavalry will neglect to screen the advancing infantry; the artillery will fail to give to the attacking lines that support which has so often turned the tide of battle, and the infantry will leave the batteries unprotected. The manner, therefore, in which the different arms play into each other's hands is the chief criterion of the tactical efficiency of an army.

The first arm that comes into play in a campaign is the cavalry. Besides getting information for the general, it has to cover the marching columns, to secure them from surprise, and to keep them acquainted with what is going on in front. The Hungarian cavalry appeared to carry out these important duties without failure. Both on the march, as well as when the columns had arrived in position, the front and flanks were well protected. From the very beginning the hussar brigades were pushed far to the front, contact was at once secured, the patrols scoured country many miles ahead of the armies, and the limit of the cavalry advance was the line occupied by the enemy. When the armies came into collision the duty of collecting and transmitting information, so far as I could observe, was not neglected. Except on one occasion, no infantry commander had to complain that the cavalry had failed to give him the necessary warning. But if the hussars, as "the eyes and ears" of the army, paid due regard to the comparative helplessness of the other arms, they showed, even more markedly, that they did not intend to leave them unaided at the crisis of the fight. It is rather the fashion, especially among people who believe in the weapon rather than the man, and who seem to think that some occult property in the magazine rifle will make it shoot straighter than those which it has superseded, to ridicule the idea of cavalry taking part in an attack on infantry. It is almost waste of time to point out that even when Brown Bess was queen of weapons, cavalry never expected to succeed against infantry unless the latter were either broken or surprised, and that the possession of a magazine rifle does not insure immunity against either of these conditions. I may, perhaps, call attention to the fact that not a single one of the great Continental Powers has as yet relegated cavalry to the subordinate *rôle*, and that the idea that the day of cavalry is gone is confined to those who have forgotten that the nerves of infantry soldiers, even if armed with the most improved of modern firearms, can easily be overstrained. Nor does the increase of range affect the question. Cavalry are not likely to attack

infantry steady enough to fire at long range, or even short range, with effect; and, as a rule, they will take care that the infantry, when the squadrons burst into view, shall have no range at all.

The Austrian cavalry, then, acts as boldly on the field as either the German or our own; and when opportunities offer, shows no hesitation in attacking either riflemen or guns. At the battle of September 20th, the 4th Corps, holding the ridges south of Balassa, made a most determined counter-stroke on the right brigade of the attack. Ten battalions, in three successive lines, swept forward suddenly from a line of woods, with the 18th Brigade of Cavalry on their outer flank. The assailants had already been exposed to a heavy fire, and rapidly fell back. Supporting them was the 6th Cavalry Brigade, which charged boldly forward to cover the retreat. The 18th Brigade, however, held well in hand, dashed out to meet it, supported by a battalion of Rifles, which was attached to it throughout the manœuvres. The volleys of the riflemen struck the advancing 6th Brigade obliquely. The Hussars of the 18th charged it in front, and it was ordered to retire. Almost at the same moment, a squadron from the second line of the 18th, passing beyond either flank of their defeated foe, rode into and captured his batteries of horse artillery, whilst another charged the flank of the retiring infantry. Curiously enough, a regiment which had been detached from the 6th Brigade rode almost simultaneously into the horse artillery batteries, which were supporting the counter-stroke. But with their main body defeated they could not have carried the guns away, and the umpire's decision sent the whole of the 6th Brigade to the rear. I have already mentioned that in the rear-guard action in the hills, three squadrons surprised attacking infantry, and these two instances are the only ones which came under my notice of cavalry joining in the main battle. As a rule, the two brigades neutralised each other. But on every occasion when either a retreat or a pursuit was ordered the cavalry acted with the greatest dash, and there was sufficient evidence to prove that their leaders are perfectly alive to the supreme necessity of the closest co-operation with the other arms.

As regards the artillery, I am not quite prepared to give so favourable a verdict. Marching well at the head of the columns, and coming rapidly into action, its early deployment not only covered the advance of the columns to their rendezvous, but gave ample time for a long preliminary bombardment of the defender's line. Moreover, on the point selected for assault a heavy fire was always concentrated; and this not merely by the artillery mass, but also by batteries or groups detached from the main line in order to bring an oblique or enfilading fire to bear upon the position.

The one point where it seemed that the artillery was lacking was in not supporting the infantry attack at close quarters. A few batteries, sent forward whilst the firing line is struggling to get forward, may not have any considerable effect on the defenders, but they will most certainly give a moral support to their own infantry, the value of which cannot be over-estimated. It scarcely needs a reference to the heroic devotion of

the German gunners in 1870, where time after time, despite tremendous losses, they unlimbered and remained in the very firing line, sustaining by their presence the courage of their sorely-stricken infantry, to show what artillery can do even under the fire of the breechloader at short range. It is true that the defensive position occupied throughout the Hungarian manœuvres ran along the crest of hills that were often 200 feet above the valleys. But on more than one occasion the batteries of the attack remained firing at 2,000 yards, over the heads of their own infantry, when ground 1,000 yards or so to the front offered a scarcely less favourable position.

The principle of concentrating the very heaviest artillery fire on the point where it is intended to break through the defence is now thoroughly understood, and invariably applied. Such procedure, however, is not without its disadvantages. Directly the mass of military deploys, its very position at once indicates the spot which the assailant has selected as most vulnerable. The defender, by moving up his reserves, can consequently make preparations at his leisure to insure his having a sufficient force at hand when the crisis of the fight arrives. The disadvantage lies in the difficulty of keeping the defender in ignorance of where the decisive attack is to be made up to the last possible moment. I noticed, both in the battles of September 19th and September 21st, that the attacking general, Prince von Lobkowitz, concentrated his artillery mass against one flank of the defence. To meet this fire his opponent had also to bring up to this point the greater part of his artillery. General von Lobkowitz, however, when he assaulted the point which had been thus prepared, delivered a strong simultaneous attack, supported by divisional batteries, against the opposite flank, and on both occasions he was very nearly successful in breaking the line at that point. On the 21st, too, the field batteries on both sides being numerically equal, the same general employed the two horse batteries attached to his cavalry brigade in the artillery duel, placing them in a most effective position on the flank of his adversary's line of guns. I have already drawn attention to the length of the artillery duel, in one case, at least, lasting well over two hours. Whether such a thing is possible I must leave for experts to decide. But with a projectile as deadly as modern shrapnel it would seem that one side or the other should get the upper hand and silence its opponent in less time than this. Of course, where each side deploys an equal number of guns it is almost impossible, *cæteris paribus*, for an umpire to give a satisfactory decision; but the whole question, in the interest of manœuvres, is well worth working out. Attention has already been directed to it in the "Duncan" essay for 1894, by Major J. F. Keir, published a few months since by the R.A. Institution.

As regards the infantry, the first thing to be noticed is that the probable effect of shrapnel is duly appreciated in the Austro-Hungarian Army. When there was the slightest possibility of meeting artillery fire, even at the longest range, all approach to column formations was invariably avoided. Never had the artillery the chance of laying on a

mass of men. Even when the advancing troops were sometimes so far distant from the guns that they could scarcely be seen with the naked eye, the field-glass showed that they were moving in successive lines. It was only in broken ground, at very long range, that deeper formations were adopted, and the small company columns, which were then employed, offered no easy target. At a distance of a mile and a half or two miles they are hardly a better mark than single rank. The conduct of the attack in Austria proceeds on well-defined lines. The theoretical battle is divided into four phases—(1) reconnaissance and rendezvous; (2) the artillery preparation; (3) the infantry attack; and (4), when superiority of fire has been attained, the assault. I have already made it clear that to the first two of these phases ample time is allotted in Austria. The infantry attack is equally methodical. During the artillery bombardment the infantry masses moved towards their objectives, out of range and out of sight; and as soon as the defender was assumed to have been sufficiently shaken, each separate column of attack, forming line after line, swept forward in successive waves upon the enemy's positions. When once the firing line got within 1,000 yards of the defender's front it set to work to beat down the hostile fire. Sometimes it was not permitted to advance to closer range, and supports and reserves were rapidly brought up to increase the volume of musketry. Very often such reinforcement was of no effect, and the umpires sent the battalions to the right-about. At other times they were permitted to push on, moving forward steadily, in unbroken lines, to closer range, and such further advance was sometimes permitted, after a few minutes of the hottest possible fire, to culminate in the assault. This final phase of the attack was made in the usual wedge formation, several companies of the second line, one behind the other, at about one hundred yards interval, dashing against the point selected for the breach. There is little, in fact, about the attack of the Austrian infantry that differs from that practised in Germany, with the exception that troops who have not, in the opinion of umpires, attained the necessary superiority of fire, are never permitted to move to the assault, and—more important still—that the troops work by battalions and not by companies. At short range the fire-fight was never unduly protracted: but troops were very often held back at 700 or 800 yards, and a long struggle took place for the mastery. Such practice seems in accordance with the teachings of experience. In the wars of 1870 and 1877 the infantry battle raged for hours at ranges varying from 600 to 300 yards—"long continued musketry fights," says Boguslawski, "often rolling backwards and forwards; at last the flank of one party turned or else one side exhausted." It may be assumed that, with the flat trajectory of modern rifles, the range at which such fights will be fought out will be somewhat increased, and the spectacle which was common in the American War of 1861-5, as well as in the war of 1870-1, of long lines of men firing at each other at effective range, until at length superior numbers or superior stanchness told, will be seen once more, with the exception that the distance which divides the combatants will be greater. This is, of course, putting the

artillery on one side If the batteries of the attack have silenced those opposed to them, and the hail of bullets poured upon the defender's line is multiplied by shrapnel, it is possible that, whether intrenched or in the open, his infantry will rapidly become demoralised.

But, infantry against infantry, the Austrian procedure seems in close accordance with the teaching of actual war. A German officer, speaking of his experiences in 1870, gives the following pertinent description of the general course of battle :—

> Without allowing sufficient time for the artillery to take effect, masses of infantry threw themselves into the fight ; the feeling in the ranks of the battle-thirsting battalions fell in with the inclination of the leaders, and hurried them along all the easier. An accurate reconnaissance of the strength and position of the enemy (in any case rendered very difficult by the fearful fire) and the establishment of a settled plan alike suffered from the hurry of the moment, and the unbridled desire to get at the enemy. Without long deliberation a bold advance was made against his strongest position. Yet we were not prepared for such a rain of bullets. Correctly judging the state of the case, our firing line pressed forward in the quickest time until within effective needle-gun range. Then arose a fire-fight of the hottest description, in which a multitude of troops became involved, who at no time were completely extended.

And he adds :—

> From the rapidity with which the attack is executed at peace exercises, the leaders were not conversant with the idea that the enemy can only be shaken by a protracted fire-fight, gradually brought nearer by a careful use of the ground. Instead of its being recognised as a normal phase that the fearful fire must necessitate a pause in the attack, even in a victorious offensive action, it was said immediately, "More troops must be sent into action."

Taking the above paragraphs as a guide, it will be seen that the methodical prosecution of the battle, in all its phases, as observed at these manœuvres, avoided all the faults into which, having no experience to guide them, the Germans fell in 1870. It is true that the Germans themselves work on different lines. Their fire-fight is of very short duration. From the moment the infantry are let loose to the attack, the advance is pushed forward, right up to the bayonets of the enemy, with scarcely a single check. *Vorwarts, immer Vorwarts!* is the spirit which rules the operation. The divergence of opinion between the thinking soldiers of these two great military nations is interesting. It is not, however, a matter of much moment to ourselves, for the necessity of attaining superiority of fire before proceeding to the assault is one of the main principles insisted on in the infantry drill-book. It may be noticed here that in Austria, when forming for attack, certain companies are told off for the "feuergefecht," instead of for "first line," the very phrase indicating the importance attached to this particular incident of battle.

The numbers employed in the grand attacks which came under my personal observation were as follows:—On September 19th, a division of fourteen battalions, formed as a single unit, and moving forward at the same moment, attacked the left flank of the defence. Before it reached the zone of rifle-fire it was reinforced by seven battalions from the general reserve. Thus twenty-one battalions, numbering 11,000 men, exactly half the whole Army Corps, were hurled in one mass against a flank on

which a heavy artillery fire had been concentrated for more than two hours. On September 20th, eleven battalions and fifteen squadrons delivered the counter-stroke which rolled up the right brigade of the attack; and on the next day a division of fourteen battalions struck the left front of the defence, another division having already struck the flank. The former advanced in no less than six lines, the first four, if I am not mistaken, composed of three battalions each.

The defensive tactics exhibited at the manœuvres were characterised by attention to the following principles:—(1) Concealment of infantry and guns up to the last possible moment; (2) retention of a large general reserve at the disposal of the army commander; (3) assumption of the offensive in great strength against the flank of the enemy's advance at the earliest favourable opportunity; and thus, at the same time, the securing of the flanks of the position. I have already, in a former letter, commented on the fact that the 4th Corps, on September 20th, occupied a front of five miles, leaving its centre very weak. The 6th Corps commander, on the other hand, adopted a more concentrated formation both on September 19th and 21st. On the 19th he covered a front of about two miles with 15,000 infantry and forty-eight field guns, and on the 21st a front of the same extent with 11,000 infantry, about the same number of guns, and some fifteen or twenty squadrons, the whole force acting as a rear-guard. In such concentrated positions the infantry reserves could be kept well in hand and rapidly moved to any threatened point, whilst batteries could be transferred with very little loss of time from one point to the other. I noticed, however, on the 19th, that a portion of the artillery of the defence never came into action until the last moment, if at all. It doubtless rendered efficient support when it at length appeared, but the whole first line had been then exposed to an artillery fire superior to its own for more than two hours. The defending general was certainly apprehensive of a sudden attack on his right flank. But modern artillery is so mobile that it can readily be withdrawn from action at one point to meet attack at another, and it appears essential for the proper security of a position that every effort should be made to prevent the enemy's batteries from overpowering the fire of the defence. In this case, moreover, favourable artillery positions were by no means lacking, and from these positions the guns could have been promptly transferred to meet the turning movement.

The dispositions of the infantry on the defensive, in most respects, could hardly have been bettered. The troops were always carefully hidden; and even when standing within the position itself it was often difficult to find the reserves. Great care was always taken to avoid even the chance fire of artillery. At no time did I see troops stationed within 500 yards in rear of their own batteries; and where by any possibility they might have become exposed to the fire of the enemy's guns the infantry were disposed chequerwise, in company columns with intervals of at least 400 yards between the successive lines. In two of the engagements the positions selected for defence included high and commanding ground, with steep slopes to the front, and a broad open

plateau sloping gently downwards in rear of the crest. Such positions are most deceptive. Apparently, from their height, most formidable, they are in reality exceedingly weak. Theoretically there are three ways of occupying such positions. The line of defence may either run at the foot of the slopes, or along the crest of the ridge, or may be withdrawn some 800 or 1,000 yards in rear. Practically the defender may have but little choice. Each one of the three possible lines may have serious disadvantages; and, as is usual in war, instead of choosing an ideal position, he has to make the best of a bad one. In the action of September 19th and 21st, the 6th Corps commander, General Kovàcs, occupied the crest. On September 20th Prince von Lobkowitz established the firing line of the 4th Corps at the foot of the slopes, leaving the higher ground to his artillery. It must be added that the slopes with which the former had to deal were both too steep and too broken to be properly defended from the bottom. Retreat would have been most difficult; supports would have found no position, and the firing line, unless unduly extended, might easily have been turned. On the other hand, the slopes of the position occupied by the 4th Corps on the 20th were both easy and open. Consequently the supports had to be held back behind the ridge, several hundred yards in rear, and would have suffered terribly when coming into action. It certainly appeared to me that on this occasion, on the right front at all events, the ridge, with the long glacis in front of it, was the best position. General Kovàcs, on the contrary, seemed to have done the best thing possible on the 19th. His position on the crest was certainly not a good one. His battalions, perched at altitudes of 150 feet to 250 feet above the plain, not only afforded excellent targets, well defined against the sky-line, but their fire from the steep heights downwards would have lost much of its effect. The advantages of flat trajectory and ricochet would have been completely lost. Nor, if the assailant had once made good his footing on the slopes, would the riflemen have been able, without actually standing up, and thus exposing themselves completely to the full force of the attacking artillery, to sweep the faces of the bluffs. Flanking fire is a most untrustworthy auxiliary under such circumstances, for the flanking detachments are themselves liable to enfilade. However, in one case I saw this expedient, on favourable ground, very judiciously applied. In the rear-guard action these disadvantages were especially manifest. The hill attacked by the centre division of the 4th Corps was so steep that it was practically indefensible against a determined assault. General Kovàcs, however, would have doubtless withdrawn his line to a second position on the plateau had such an operation been attempted. On the 19th, he might possibly have withdrawn his troops to a position in rear of the crest from the very outset, leaving only a thin line to attract the enemy and induce him to make a direct attack. But the plateau in rear was absolutely open, without a foot of cover. It was commanded on one flank by a height which he had not rifles enough to hold; whilst, holding the crest, he found ample shelter for his troops, and his flanks were strong. The wisest plan was the one he adopted, to hold the crest, and to rely upon a

counter-stroke for success. Of field intrenchments some use was made in the shape of either solid breastworks constructed by the Pioneers—a corps distinct from the Engineers—or hasty trenches, often of most insignificant profile, thrown up by the infantry. Gun pits were seldom resorted to. On the whole, natural cover seemed to be preferred to works which might have exposed the lie of the position and the arrangements for its defence.

I trust that I have now made clear the manner in which the Austro-Hungarian Army intends to deal with the problems which modern tactics involve. To make a just estimate of its fighting value possible, it will be necessary to describe the working of the staff, and of each arm in detail. But I think it is evident that the superior officers are well abreast of the present standard of efficient leading. Errors of judgment were no doubt apparent in the manœuvres. But so difficult an art is war, so dark the veil which a general has to penetrate, so short the time given for decision, that errors are inevitable. No leader, not even the greatest, not Hannibal or Napoleon, but has blundered; and where faults are few and an adherence to sound principles is generally manifest, it is only mischievous to condemn.

(To be continued.)

THE VICISSITUDES OF REGIMENTAL COLOURS.

By Major R. HOLDEN, 4th Bn. Worcestershire Regiment.

PART I.

TO soldiers, colours have always been sacred. In the days of the Roman Legion the attachment of the troops to their standards was inspired by the united influence of religion and of honour. The golden eagles, which glittered in the front of the legion, were the objects of their fondest devotion; nor was it esteemed less impious than it was ignominious to abandon those sacred ensigns in the hour of danger (1). They were placed in a chapel in the camp, and with the other deities received the religious worship of the troops (2). Julius Cæsar's practice, in case of disorder when engaged with the enemy, was that the troops should rally and form round the first standard they could find, and not lose time and opportunity by hunting for their own (3). The relation in which the British soldier of to-day stands to his colours was explained by the Duke of Wellington in presenting a new set to the 72nd Highlanders, in 1842:—"You are henceforth to consider them as your headquarters, and in every circumstance, in all times of privation and of distress, you will look to them as your rallying point" (4). His great opponent attached the utmost significance to these emblems. At the celebrated convocation of "Champ de Mai," on 1st June, 1815, Napoleon took his seat on the throne in the middle of the ground, and the troops marched in battalions and squadrons, and surrounded the throne. He then presented to each its eagle, and said:—"Soldiers of the National Guard of Paris! Soldiers of the Imperial Guard! I confide to you the national eagles, and the national colours. You swear to perish, if necessary, in defending them against the enemies of the country and the throne." The whole army, drawn up in close order around him, replied with repeated exclamations of "We swear it!" The drum rolled and silence was restored. "You swear," continued Napoleon, "never to acknowledge any other rallying sign." Again the cries of "We swear it!" resounded on every side (5).

Amongst the earliest banners or colours known to have been carried on active service and still preserved is the Douglas banner or standard,

(1) Gibbon's Decline and Fall of the Roman Empire. Vol. I., p. 11.

(2) Annals of Tacitus.

(3) Bel. Gal. II., 21.

(4) Colburn's *U.S. Magazine*, 1842.

(5) Siborne's History of the Waterloo Campaign. Vol. I., p. 421.

which was borne at Otterburn in 1388, and is now in possession of Captain Palmer Douglas, of Cavers, Hawick, N.B. In the Edinburgh Naval and Military Exhibition of 1889 were exhibited several flags carried by the Covenanters at Drumclog and Bothwell Brigg, in 1679. Viscount Dillon has in his possession, at Ditchley, Oxfordshire, the colour carried by the Dillon Regiment, in the service of France, at Fontenoy in 1745. And Colonel Grant Kinloch, of Logie, Kirriemuir, N.B., has the colours of a battalion of Lord Ogilvy's rebel regiment, carried at Falkirk and Culloden, in 1746.

Each troop in a cavalry regiment, and every company in an infantry battalion, carried a standard or colour until the reign of William III., when they were, in the case of the infantry, reduced to three per battalion, and finally, in Queen Anne's reign, to two. The first was called the Queen's colour, and the second the Regimental colour [1]. It appears, however, that the 2nd Queen's and the 5th Fusiliers exercised the right to carry a third flag; the first-named until officially ordered to lay it aside in 1835 [2], and the latter until it was, with the two other colours of

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[1] Major-General Sir F. B. Norman, K.C.B., late of the Bengal Army, has very kindly supplied me with the following interesting information regarding the colours of Native regiments:—"The Bengal and Madras Sepoy regiments carried a colour in each company until the reign of George II. In Bengal they were of the colour of the facings of the regiment, with the Subadar, or Native Captain's badge of a sabre, dagger, or crescent, in the centre; the Grenadier Company, however, had the British Union in the upper canton as a distinction. In Madras, the company colours were the same as the facings of the battalion, but those of the 6th Battalion were red and yellow striped diagonally, and those of the 7th Battalion red and green striped diagonally: the colours of the Grenadier companies of the first four battalions were distinguished by a red cross, the 5th Battalion by a white cross, the 6th Battalion by three parallel stripes of red, yellow, and red, and the 7th by three parallel stripes of red, green, and red. The regimental colour of a battalion of Bengal Sepoys, raised in 1763, was the red cross of St. George on a white field. Until May, 1781, the cost of the colours had been defrayed by stoppages from the men's pay, but on that date the Government of India ordered each regiment of Native Infantry to be supplied with a pair of colours at a cost of 400 sonat (rupees) a pair. They were to be made of the best China silk. The size to be 7 feet wide, and 6 feet 6 inches deep on the pike, the length of which, from the top of the spear-head to the end of the ferrule, was to be 10 feet. The cords were crimson and gold. The first colour was to be the Great Union, the second the colour of the facings of the regiment, with the number of the battalion within a wreath embroidered in gold Roman letters. In September, 1797, three standards were sanctioned for each of the regular Native cavalry regiments recently raised in Bengal." The Native soldier holds his colours in great reverence, and recruits, when enlisted, are sworn in upon them. To Mahomedans the oath is administered by the Regimental Moulvie, to the Sikhs by the Gorroo, and to Hindoos by the Pundit.

[2] The third, or honorary, colour of the 2nd Queen's, which was green, with the badge of the Paschal Lamb in the centre, was ordered to be given up in 1750, at Dublin, where it remained, until discovered in a mutilated state, in 1824, at the Royal Hospital. By permission of George IV. it was repaired by Lady Torrens, wife of Major-General Sir Henry Torrens, Adjutant General, and Colonel of the regiment. By him it was, by permission of the King, restored to the regiment at Chatham, on 31st January, 1825. In August, 1835, it was permanently withdrawn.

the regiment, accidentally burned, at Gibraltar, in 1833 (1)—a fate which in recent years has befallen, amongst others, those of the 1st Battalion the Royal Irish, 1st Battalion the South Lancashire, and the 3rd Battalion the Cheshire Regiments.

In consideration of its services at the action of Sholinghur, on 27th September, 1781, the 21st Battalion, now the 20th Madras Native Infantry, was permitted to carry a third colour, which it captured from Hyder Ali. The regiment still carries the honorary colour (2).

A more modern privilege to display a third, or honorary, standard or colour, was conferred by the Government of India upon the 1st Battalion of the 4th Bengal Native Infantry for its good conduct in the assault and capture of Aligurh, on 4th September, 1803 (3), and upon the British and Native regiments engaged at the battle of Delhi, on 11th September, 1803, and that of Assaye, on 23rd September, 1803. Those which received the distinction for Delhi were the 27th Light Dragoons (4), the 76th Regiment (5), the 1st and 2nd Battalions of the 2nd Bengal N.I., the 2nd Battalions of the 4th and 12th Bengal N.I., the 1st Battalion 14th Bengal N.I., 1st and 2nd Battalions 15th Bengal N.I. (now the 2nd Queen's Own Bengal N.I.), and the 2nd Battalion 17th Bengal N.I. The regiments which earned the distinction of an honorary colour for Wellington's victory of Assaye were the 19th Light Dragoons (6), the 74th (7) and 78th Highlanders (8), the 1st Battalions of the 2nd, 4th, 8th, and 10th Madras N.I., and the 2nd Battalion of the 12th Madras N.I. These honorary distinctions were not issued till between four and five years later, and that awarded to the present 2nd (Queen's Own) Bengal N.I., then the 1st and 2nd Battalions of the 15th Bengal N.I., bore the words "Lake and Victory" embroidered in a wreath under the other devices. Native officers invariably carry the colours of their

(1) The 5th Fusiliers for many years carried a third, or drummers' colour. The original one is supposed to have been a French standard, captured by the drummers of the regiment at Wilhelmstal, in 1762, and afterwards carried in their ranks. On its getting worn out, a new colour of green silk, inscribed with the badge, motto, and number of the regiment, was substituted. On new colours being presented to the 1st Battalion, in 1836, the Authorities declined to recognise the drummers' colour, but a green banner is still carried in their midst.

(2) Wilson's History of the Madras Army. Vol. II., p. 49.

(3) Williams's History of the Bengal Native Infantry, p. 283.

(4) The 27th Light Dragoons was raised in 1795 by Major-General Blathwayte, and had a distinguished career in India. It was disbanded as the 24th Light Dragoons in 1819.

(5) The 76th Regiment, now 2nd Bn. West Riding Regiment, received two sets of colours from the E.I. Company, as explained further on.

(6) The 19th Light Dragoons was raised as the 23rd Dragoons, in 1781, and numbered 19th in 1783. It had a distinguished Indian career, and was disbanded as the 19th Lancers in 1821.

(7) The 74th Highlanders, now 2nd Battalion Highland L.I., carries a third colour to this day.

(8) Of the honorary standard presented to the 78th Highlanders, now 2nd Bn. Seaforth Highlanders, no trace can be found.

regiments, and on the issue of these colours an additional Jemadar in each battalion was sanctioned for carrying them (1).

The 6th Bengal Light Cavalry earned an honorary standard for a gallant charge made by three troops of the regiment at Seetabuldee, on 26th November, 1817. This standard was captured by the Sikhs at Chillianwallah in 1849 in the following circumstances:—The Jemadar who bore it, having secured it to his body by way of precaution, was killed, and the Havildar-Major who attempted to unfasten it from the dead body was vigorously attacked by the Sikh horsemen, who eventually succeeded in carrying off the standard (2). The regiment mutinied in 1857, and was removed from the Army.

In 1843, the 9th Bengal Light Cavalry, which was struck off the Army List for mutiny in 1857, was granted an honorary standard for gallantry in the battle of Meanee. The 5th Regiment of Bombay Cavalry (Sindh Horse) and the 6th Regiment of Bombay Cavalry (Jacob's Horse) were each granted an honorary standard for service in the same campaign. In both the latter cases, the standards bear the device of a native horseman with a lance (2).

Another distinction was awarded in 1843, when Lord Ellenborough, by a general order of 4th January, directed "that an honorary flag of the three colours of the military ribbon of India, having inscribed thereon *Ghuznee* in English, Persian, and Hindee, should be given to the escort with the gates of Somnath," and Captain MacLean, the commandant of the escort, which was composed of volunteers from the 2nd Regiment Bengal N.I. (Grenadiers), was informed that on the return of the escort to their regiment, the flag was to be retained as a third colour in commemoration of their distinguished service. It was intended that the gates should be escorted to the Temple of Juggernaut, but they never got farther than Agra (3).

In 1857, the 4th (Prince Albert Victor's Own) Regiment of Bombay Cavalry (Poona Horse) captured a standard from the Persians in the battle of Kooshab, which it is permitted to carry. The standard is surmounted by a silver hand and bears a Persian inscription (4). But the most unique distinction belongs to the present 2nd (Prince of Wales' Own) Gúrkha (Rifle) Regiment (The Sirmoor Rifles). For its distinguished service at the siege of Delhi in 1857 as the Sirmoor Rifle Battalion, the regiment was awarded the great distinction of carrying colours similar to those of regiments of the line, and an extra or honorary regimental colour on which the word *Delhi* is inscribed in English, Persian, and Hindee (5). In 1863, the regiment was further honoured by

(1) Williams's Bengal Native Infantry, published 1817, p. 378; and General Sir F. B. Norman's MS.

(2) General Sir F. B. Norman's MS.; Lieut-General F. H. Tyrrell, late of the Indian Army, also kindly supplied me with this and other interesting information regarding native colours.

(3) General Sir F. B. Norman's MS.

(4) General Sir F. B. Norman's MS.

(5) General Order, 25th August, 1858.

Her Majesty the Queen presenting to it an *honorary truncheon*, which was formally handed over to the corps by the Commander-in-Chief, Sir Hugh Rose, at an evening parade held at Lahore on 30th November, 1863 (1). The 3rd Madras Light Cavalry used to carry a third colour called the "*Whitlock colour*," which was awarded to the regiment by General Whitlock, for services in connection with the Kirkee booty during the Indian Mutiny, but there being no authority forthcoming, it was ordered to be withdrawn (2).

The actual ceremony of consecrating banners and colours is one of great antiquity. The old Ordo Romanus, in the tenth century, contains a form, much resembling the prayer at present in use, for the consecration of a knight's gonfalon, as an essential feature in the ceremonial of his investiture. The earliest ceremony of a regular consecration in the British Army which I can find is that observed on the presentation of colours to the 85th Light Infantry (Royal Volunteers) at Shrewsbury, on 2nd January, 1760. During the prayers and sermon, the colours were held over the heads of the Lieut.-Colonel Commandant and the Lieut.-Colonel. The Regiment was then marched to the Quarry, where the colours, held by these two officers, were saluted and kissed: the regiment was raised in 1759, and disbanded in 1763. But the consecration of the colours of a regiment prior to their being taken into service was not systematically adopted until the commencement of the present century. And, even after the change, the Authorities, in 1824, ordered the colours of the 96th Regiment to be taken into use without any ceremony of either presentation or consecration, though, fortunately, the general who inspected the regiment in the following year thought a ceremony advisable, and ordered one to be held. Between 1849 and 1853 the colours of, amongst others, the 27th, 57th, 71st (3), and 82nd Regiments (4) were taken into use without any ceremony; and it is curious that the colours of the Foot Guards are treated in a similar manner, being issued like ordinary stores every five or seven years.

An interesting ceremony of blessing the colours takes place in some Native regiments every year. An illustration of that performed in connection with the 2nd (Queen's Own) Bengal Native Infantry, the regiment already alluded to, was given in the *Graphic* of the 3rd November last. At the regimental annual festival, called the Nishan Pujah, the colours are blessed according to the Hindu rites. Three Native officers carry the colours—including the third, or honorary, colour—up to the fire in front of the officers' mess tent, and the Subadar Major, or senior Native officer, taking a gold dish containing burning incense, wafts it round each colour, and places a garland of white flowers on each.

(1) General Sir F. B. Norman's MS.

(2) Letter of Lieut-General F. H. Tyrrell, 1894.

(3) Milne's Standards and Colours of the Army, pp. 232-234; and History of 14th Regiment, p. 298.

(4) Jarvis's Historical Record of the 82nd Regiment, p. 74.

The priest then ties a gold cord round the right wrist of each Native officer and man of the colour party. After the ceremony the colours are escorted back to the battalion. This regiment is a most distinguished one, and carries a third, or honorary, colour for its services at Delhi, in 1803, as already narrated. The regiment was raised in the Province of Bengal as the 2nd Battalion 15th Bengal N.I. Under the reorganisation of 6th May, 1824, it became the 31st Bengal N.I., and, having remained faithful during the mutiny, it became, upon the reorganisation after this event, the 2nd Bengal N.I.

An idea prevails that Artillery, either in India or at home, at one time carried colours. We read in "Orme's Affairs in Hindostan," published in 1780, that the "English colours were carried on the flag-gun of their artillery"; and again, at Goojerat, in 1849, we hear of the advance "of the stately elephants, the central one bearing on its back the banner of St. George, with its red cross on a white field, waving in the light breeze. These animals were drawing the heavy guns, which had only a few days before reached the Army" (1).

The colours of regiments were originally provided by Commanding Officers, and eventually became their property, but now they are issued by the War Office as portion of the regimental equipment. Instances, however, have occurred in which private individuals have been permitted to be the donors. The Duke of Northumberland, on relinquishing the command of the 5th Fusiliers in 1784, presented the regiment with a pair of colours, which were taken into use the following year. The Royal Princesses of England worked and presented a set to the 7th Royal Fusiliers between 1790 and 1800 (2). The 76th received a set from the East India Company in 1807, on the spearheads of which was engraved a long inscription setting forth the circumstances. When they were worn out in 1830, the regiment received another set from the same quarter, which were carried until 1863 (3). The 56th received a set in 1811. The Coldstream Guards were presented by Queen Charlotte with a Royal Standard at the end of last century, which was carried on State occasions until about 1850, when it was ordered to be withdrawn, as no written authority for its use could be shown (4). In 1831 the 70th received a set worked and presented by Miss Evans, daughter of the Commanding Officer (5), and in 1832 William IV. presented the Royal Horse Guards with a standard (6).

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(1) Archer's Punjab Campaign, p. 103.

(2) Now in the possession of the regiment and restored to them by Lady Augusta Fitzclarence. Historical Record of the Royal Fusiliers, published privately, p. 160.

(3) Milne's Standards and Colours of the Army, published by Goodall and Suddick, Leeds, in 1893. A most valuable work, giving the most accurate information about colours of British regiments.

(4) *Ibid.*

(5) Colburn's *U.S. Magazine*, 1831.

(6) Historical Record of the Royal Horse Guards, by Packe, p. 128.

THE honour of a regiment being to some extent involved in the prevention of the colours from falling into the hands of an enemy, it is not surprising that history reveals many heroic efforts on the part of both officers and men in their preservation. At the battle of Steenkirk, in 1692, when the Royal Regiment (now the Royal Scots) so distinguished itself, the first battalion for a time lost one of its colours. Colonel Sir Robert Douglas, who had already given astonishing proofs of personal bravery, seeing the colour on the other side of the hedge, leaped through the gap alone into the thickest of the enemy's ranks, slew the French officer who bore the colour, and cast it over the hedge to his own men. But the act of gallantry cost him his life, for a French soldier shot him dead as he was in the act of repassing the hedge (1). At the battle of Blenheim, in 1704, where the 21st (now the Royal Scots) Fusiliers, behaved with great gallantry and lost 19 officers killed and wounded, they for a time lost one of the colours, but afterwards recovered it (2). At Dettingen, in 1743, Private Thomas Brown, 3rd Light Dragoons (now Hussars) received eight wounds in the face, body and hands, while three balls passed through his hat, in defending and recovering from capture a standard of his regiment. At Fontenoy, in 1745, Cornet Richardson, 7th Light Dragoons (now Hussars), preserved the standard of his regiment at a cost of thirty sabre cuts on his body; while at Rousbech, in the Netherlands, in 1794, Private Michael Maneely, 8th Light Dragoons (now Hussars), received several severe wounds and had his horse killed under him. He fainted from loss of blood and was taken prisoner, but not before he had successfully concealed his charge by burying it in the field. And yet, strange to say, cavalry standards are never consecrated, and have not the same veneration attached to them which those of the infantry invariably inspire. The 37th (now the 1st Battalion Hampshire Regiment) much distinguished itself in Flanders, under the Duke of York in 1794, and particularly at Drutin on the Maes, on the 19th October, in defence of its colours. On this occasion the Regiment refused to surrender to the French, who made a charge upon the colours in the hope of their capture, but they were very bravely defended at much sacrifice of life. One of the colours did actually fall into the hands of a Hussar, but before he could make off with it he was killed by a sergeant of the 37th. Both colours were eventually preserved, to the great honour of the Regiment (3). During the operations in the Jeypoore country against the forces of Holkar in 1804, Colonel Monson's force, on being threatened by that chief with a powerful army of horse, artillery, and infantry, commenced a retreat into the Company's territories, and the rear-guard, under the gallant Major Sinclair, was nearly annihilated at the passage of the Banass River on the 24th August. On this occasion a remarkable instance of heroism and devotion was displayed by a Subadar

(1) *London Gazette*, 1692; and Cannon's Historical Record of the 1st Foot, 1838.

(2) Clarke's Historical Record of the 21st Fusiliers, p. 10.

(3) Journal of the Campaign, 1794-5, published in 1796, p. 91.

or Jemadar of the 2nd Battalion of the 2nd Bengal Native Infantry, who was seen from the opposite side of the river, retiring with one of the colours of his regiment grasped in one hand, and defending himself, against over-whelming numbers, with the other. On reaching the bank of the river he plunged into it, but the fine fellow sank with the colours to rise no more [1].

The King's colour of the Buffs was miraculously preserved at Albuhera in 1811 by Lieutenant Mathew Latham under circumstances rarely equalled and never excelled for bravery [2]. The whole side of his face and nose was severed by a sabre cut which disfigured him for life, a second stroke struck off his left arm and the hand in which he held the colour. He was pierced with lances, thrown down, trodden upon, and left for dead. But, exerting what little strength remained in him, he tore the colour from the pole and concealed it under his body, where it was found by a sergeant of the 7th Fusiliers after the battle, when Latham was picked up for dead. The regimental colour was carried by Ensign Edward Price Thomas, a brave boy of fifteen years of age, who, upon being surrounded by the enemy and called upon to surrender the colour, refused to resign it except with his life. The noble youth fell pierced with many wounds, and his life paid the forfeit of his devoted gallantry. The colour was captured, but recovered by the 1st Battalion 7th Fusiliers, when the Fusilier brigade advanced, immortalised itself, and "stood triumphant on that fatal hill." Young Thomas was born in Jamaica, and, being an orphan, was adopted by his uncle, Surgeon Matthews, of the Buffs. He entered the regiment in 1810 at the age of fourteen, and had already, at Albuhera, shown unusual bravery before the defence of the colour cost him his life. When the regiment was broken by the French cavalry, he took command of Captain Stevens' company on his being wounded and taken prisoner, crying out "Rally on me, men, I will be your pivot." He was buried by a sergeant and private of the Buffs, the only two survivors of his company which went into action sixty-three strong [3].

At Quatre Bras, in 1815, a somewhat similar act of chivalrous daring was performed in defence of one of the colours of the 44th (now the 1st Battalion Essex Regiment). A French lancer gallantly charged at the colours, and severely wounded Ensign Christie who carried one of them, by a thrust of his lance, which, entering the left eye, penetrated to the left jaw. The Frenchman then endeavoured

(1) Captain Williams' History of the Bengal Native Infantry, published 1817, p. 371.

(2) Colburn's *U.S. Magazine*, 1889, p. 159.

A fine representation of these colours is given in Milne's Standards and Colours of the Army, p. 174.

Lieutenant Mathew Latham entered the Service in 1805 as Ensign in the Buffs; became Lieutenant, 1807; Captain, Canadian Fencibles, 1813; Captain, Buffs, 1813; retired half-pay, 1820; and died in 1865. He had a special pension of £170 a year for wounds.

(3) Appendix to 3rd edition of Lord Londonderry's Narrative of the Peninsular War, vol. 2, p. 317.

to seize the flag, but the brave Christie, notwithstanding the agony of his wound, flung himself upon it—not to save himself, but to preserve the honour of his regiment. As the colour fluttered in its fall, the Frenchman tore off a portion of the silk with the point of his lance; but he was not permitted to bear the fragment beyond the ranks. Shot and bayonetted by the nearest of the soldiers of the 44th, he was borne to the earth, paying with his life for his display of bravery (1).

Amongst the many extraordinary incidents connected with the services of the British Legion in Spain in 1836 was a very gallant action in defence of the colours of the 3rd Regiment or Westminster Grenadiers, performed by Second Lieutenant C. Chadwick, on 5th May, in which action he was mortally wounded. In the different assaults on that day the colours were in the thick of the fight, and on the retreat of the regiment the regimental colour carried by young Chadwick was seen firmly fixed to a particular spot while the balls flew thick round him, perforating the waving silk. He received a severe wound in his loin from a musket shot, but, lying bleeding on the ground, still held the colour upright. Refusing to quit his hold, he was, on the near approach of the enemy, carried bodily to the rear, still waving the colour above his head. He tried to go forward again when his regiment rallied, but was too weak, and he succumbed to his wound. He was only eighteen years of age at his death, and had previously been a midshipman in the Royal Navy. He was buried with military honours, and the colour which he had so bravely carried was laid on his coffin (2).

And coming to times more recent, we have the heroic efforts made by Lieutenant and Adjutant Melvill and Lieutenant Coghill to save the Queen's colour of the 1st Battalion of the 24th (now South Wales Borders) after the disaster at Isandhlwana in 1879. Some days after their death the colour was discovered in the Buffalo River wedged between two stones, and was subsequently honoured by the Queen decorating it herself with a wreath of immortelles.

At the battle of Bergen, in Holland, on the 19th September, 1799, where the 35th (now the 1st Battalion Royal Sussex) lost eight officers and 350 rank and file killed, wounded, and missing, Ensign John Renton, carrying one of the colours of the 1st Battalion, on seeing his brother ensign killed by his side and the colour in danger of being captured, stripped it from the staff and bound it with his pocket-handkerchief to his thigh. His own colour he also stripped from the staff and tied round his body. In this position he was attacked by three French officers, and, after killing one and breaking his sword, kept off the attacks of the other two with the staff of one of the colours. He was the means of saving both

(1) The actual fragment of the colour is carefully preserved in the Officers Mess of the 1st Battalion Essex Regiment.

Ensign James Christie was promoted from Sergeant-Major, to be Ensign in the 44th, on 26th November, 1812; he was promoted to Lieutenant, 26th October, 1815, for his gallantry at Quatre Bras. He shortly afterwards retired on half-pay.

(2) Somerville's History of the British Legion in Spain, p. 367.

the colours of the battalion. At Gordon Castle is deposited an old regimental colour of this regiment which, from the appearance of the small portion of embroidery left, was evidently made 1790—6, and may be the remains of that which Ensign Renton so pluckily saved (1).

The method of concealing a colour by detaching it from the pole and wrapping it round the body has often been resorted to. At Albuhera in 1811, Ensign Richard Vance, 29th Worcestershire Regiment, in his anxiety for the regimental colour at a critical period of the battle, tore it from the pole and concealed it in the breast of his coat, where it was found on his dead body (2). When the 73rd, now the 2nd Battalion of the Black Watch, formed fours for the final advance at Waterloo, the Commanding Officer ordered the colours to be rolled round the body of a trustworthy sergeant and taken to Brussels, as there were no officers left to carry them.

At the last stand of the 44th, between Gandamuck and Jellalabad in 1842, Lieutenant Souter preserved the regimental colour by concealing it round his body, and though it was taken from him during his captivity, he ingeniously recovered it, and eventually restored it to the regiment. It now rests peacefully in the Church of Alverstoke in Hampshire. The other colour was lost under circumstances detailed farther on.

Of the practice of concealing the colours, when, in accordance with the strict rules of war, they should have been surrendered, there are several instances. When the British surrendered to the Americans at York Town in 1781, the officers were permitted to return to Europe on parole and retain their private property. The officers of the 23rd Fusiliers carrying the colours, removed them from the poles and wrapped them round their bodies, and they were eventually restored to the regiment (3). The 33rd, on the same occasion, failed to deliver up theirs, but whether they were with the regiment at the time or left at New York is unknown (4). The officers of the 55th, now the 2nd Battalion Border Regiment, to prevent their colours falling into the hands of the French at Bergen-op-Zoom in 1814, stripped them from the poles, which were broken up and thrown over a wall, and wrapped them round the bodies of Ensigns Goodall and Ring, who successfully concealed them, and, upon being released, brought them out to the regiment (5). On the same occasion, those of the 2nd Battalion 21st, the 33rd, 2nd Battalion 44th, and 2nd Battalion 91st Highlanders, were saved by the escape of their bearers over the ramparts before the series of surrenders took

(1) Ensign John Renton was Lieutenant and Adjutant of the 1st Surrey Militia in 1797—99, became Ensign 35th Regiment and Lieutenant 1799. After 1801 his name does not appear in the Army List.

(2) Ensign Richard Vance joined the Dublin County Militia as Ensign 21st December, 1808, and was transferred to the 29th Foot, 26th October, 1810.

(3) Major Broughton-Mainwaring's History of the Royal Welsh Fusiliers, p. 106.

(4) Milne's Standards and Colours of the Army, p. 112.

(5) Noakes' historical account of the 34th and 55th Regiments, p. 69. The colours were eventually placed in the Parish Church of the regimental county town, Kendal. See also *Westmoreland Gazette*, 27th October, 1888.

place (1). But what shall be said of the ingenuity of the Adjutant of the 4th Battalion the Royal Scots, Lieutenant Galbraith, who, prior to his battalion laying down their arms, weighted the colours and sank them in the river Zoom (2). But they must have been found by the enemy, for they were shortly afterwards in possession of the French Commander Bizanet, and by him presented to the hospital of the "Invalides" in Paris, where they are at this moment.

The most recent case of this kind occurred in the disastrous Boer War in 1880-1, when the 94th, now the 2nd Battalion Connaught Rangers, were compelled, after a gallant resistance, to surrender to a superior force of the enemy under Joubert, near Prinsloe's Farm, on the Madder Spruit, on 20th December, 1880. The despatch of Lieut-Colonel Philip R. Anstruther, commanding the regiment, tells its own tale:—"Observing that all the officers, and about two out of three of the non-commissioned officers and men, were either dead or wounded, I ordered the 'Cease Fire' to be sounded, and hoisted a flag of truce to save the lives of the remainder." The loss of the regiment, which went into action 246 of all ranks, amounted to six officers and 141 non-commissioned officers and men killed and wounded. Orderly-Room-Clerk Maistre, and Sergeant-Master-Tailor Pears, in the absence of officers, carried the colours, which they succeeded in hiding in a waggon; and Conductor Egerton, Army Service Corps, though wounded, tore the colours from the poles, wrapped them round him under his coat, and carried them safely to Pretoria (3).

This reminds one of the curious fatality which befell the colours of the 69th, now the 2nd Battalion Welsh Regiment, in 1795. The regiment sailed from Gibraltar with some ships of war convoying a rich fleet of merchant vessels from the Levant. Off Cadiz a French fleet, under Admiral Richery, bore down upon the British. The English Admiral signalled "disperse" to his convoy, and with his ships of war, though much inferior, formed line against the enemy. A fight of brief duration ensued, the French Admiral was victorious, and half the merchant ships, together with the whole of the 69th, fell into his hands. The senior officer of the 69th, Captain R. O'Dogherty, seeing the vessel which carried his men about to strike to the enemy, wrapped the colours of his regiment round cannon shot and sank them (4). This was not the only occasion upon which colours have been cleverly kept out of French hands. The 4th (King's Own), on

(1) Milne's Standards and Colours of the Army, p. 179. The colours of the 21st were deposited in St. Giles' Cathedral, Edinburgh, in 1883.

(2) History of the 1st Royal Regiment, by Major, afterwards General Sir George Augustus Wetherall; published in 1832 at the expense of General George, Duke of Gordon, Colonel of the Regiment.

(3) *London Gazette*, 29th March, 1881. Conductor Ralph Egerton, for his distinguished service, was appointed Second Lieutenant in the 94th Regiment, on 18th June, 1881, and is now a Major in the West India Regiment.

(4) Sir William Butler's History of the 69th Regiment, p. 16.

sailing from Quebec in 1797 in a transport, were chased by a French privateer, "La Vengeance," and several officers and men were wounded in endeavouring to defend the ship. When, from the superior metal and power of the enemy, no hope of escape remained, the regimental colours were sunk in the sea near the Land's End, and the transport surrendered(1). In 1810, when communication with India, owing to the activity of French cruisers in the Indian Ocean, was at times uncertain, two or three East Indiamen, conveying the 1st Battalion 24th Regiment from Cape Town to India, were captured by a French squadron in the Mozambique Channel, and the officers and men, after a gallant fight, taken prisoners to Mauritius. To escape capture the colours of the regiment were thrown overboard (2).

In the wreck of the Transport "Seahorse" in the Bay of Tramore, County Waterford, on 30th January, 1816, by which 12 officers and 264 non-commissioned officers and men of the 2nd Battalion of the 59th Regiment, now 2nd East Lancashire, perished, the colours of the battalion were lost; fortunately, however, one was afterwards washed ashore. The survivors, together with another detachment rescued from the "Lord Melville," also wrecked near Kinsale, on the following day, were transferred to the 1st Battalion, and the 2nd Battalion ceased to exist (3).

The 62nd, now the 1st Battalion the Wiltshire Regiment, lost two sets of colours within a year or two, and in almost the same spot. On its way up the Ganges to Dinapore, in 1842, the regiment was overtaken by a tornado, and the boat, containing amongst other things the colours, was lost near the Nowgong Rocks. They were recovered a year later, but were unfit for use, and now hang in Salisbury Cathedral. Their successors, which were carried in the Sutlej campaign of 1845-46, accompanied the regiment up the Ganges to Calcutta on its way home, and, strange to say, were in the Colonel's boat which was wrecked almost at the very place where four years previously their predecessors were lost. The boat with its contents took fire, and the colours were completely destroyed (4).

Upon the principle, perhaps, that all is fair in love and war, many questionable contrivances have been resorted to in order to prevent the enemy obtaining possession of British colours. On the surrender of Burgoyne's army at Saratoga, in 1777, the 53rd managed to retain possession of theirs. Tradition says that they were cut off the staves by the officers during the retreat from Ticonderoga (5). The 62nd

(1) *Naval and Military Magazine, 1828. Vol. 4, p. 320.*

(2) Historical Records of the 24th Regiment; published 1892, p. 90.

(3) *Narrative of the Wreck, published at Waterford, 1816, p. 21.*

(4) Milne's Standards and Colours of the Army, p. 226.

(5) Colonel Rogerson's *History of the 53rd (Shropshire) Regiment, p. 15.* The colours, which subsequently became the property of the Colonel, General Elphinstone, are still preserved at Logie Elphinstone, in Aberdeenshire.

stripped theirs from the poles, which they burned [1]. The 20th are reported to have burned their colours, poles, and all, rather than allow the Americans to possess them [2].

During the passage home from India in 1825 the 31st, now the 1st Battalion East Surrey Regiment, lost their colours when the "Kent" East Indiaman was destroyed by fire in the Bay of Biscay during a storm. Of the headquarters and five companies on board at the time, seventy-six men, women, and children perished [3]. Never was the capacity of the regiment put to a severer test, and never was its ready obedience, unfailing discipline, and manly resignation more conspicuous.

The colours of the 54th, now 2nd Battalion Dorsetshire Regiment, very nearly suffered a similar fate during the fire which broke out on the "Sarah Sands" Transport at sea in November, 1857. Amongst the many acts of devotion and heroic courage shown by all ranks of the regiment, the saving of the colours on that occasion was not the least conspicuous. The colours were fixed against the end of the saloon, which was full of smoke, and the first attempt of Lieutenant and Adjutant T. B. Houston and Lieut. J. W. Hughes to rescue them failed. The ship's quartermaster, R. Richmond, wrapping his face in a wet cloth, then rushed in armed with a hatchet and cut them down, but fainted before he could emerge from the suffocating smoke. Private W. Wiles finally succeeded in dragging him and the colours from the saloon, for which act of bravery he received the medal of the Royal Humane Society, and an extra 6d. per diem to his pension [4]. Lieutenant Houston was promoted to a company in the 4th Foot, and Lieutenant Hughes, on obtaining his company, was promoted to a Brevet Majority. The actual colours were, on the 19th January, 1865, deposited with much ceremony in Norwich Cathedral.

Apropos to the burning of colours, very extraordinary proceedings attended the destruction of a set belonging to the 2nd Battalion of a well-known regiment on its disbandment at Portsmouth in 1815. After dinner on the evening preceding the disbandment, the colours were stripped from the poles with dessert knives, and the remains distributed. The poles were hacked with a carving knife, broken across the knees of one of the officers, and, with the fragments of the colours and the tassels, thrown into the fire. The ashes were then collected and buried with mock ceremony in the barrack yard, one of the captains completing the farce by reading a prayer over them. On the report of this scene, unprecedented in the history of the army, reaching the Horse Guards, a severe reprimand was administered to the regiment in a General Order, and the commanding officer narrowly escaped a court-martial [5].

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[1] "The Springers," by H. M. Carter, p. 16.

[2] Lieutenant Smyth's History of the 20th Regiment, p. 91.

[3] Cannon's History of the 31st Regiment, p. 95.

[4] History of the 54th Regiment, published at Roorkee; p. 67.

[5] Colburn's *U.S. Magazine*, 1830. Part II., p. 844.

It may not be generally known that the burning of colours was at one time considered an act of degradation and disgrace. As late as the year 1745 the rebel colours taken at Culloden were marched from Edinburgh Castle to the City Cross, and there burned by the public hangman (1). But even the burning of colours, when performed gracefully and decently, may become an act of reverence worthy of imitation. When the present 2nd Battalion of the Highland Light Infantry, then the 74th Highlanders, were presented with new colours at Fermoy in 1818, the old tattered ones, which had waved over the regiment in many a hard fought field in India and the Peninsula, were burned, and the ashes deposited in the lid of a gold sarcophagus snuff-box, inlaid with part of the wood of the colour poles, on which a suitable inscription was engraved (2). During the celebrated retreat from Moscow in 1812, the French officers in many cases burned their eagles and drank the ashes (3).

On the 50th, now the 1st Battalion (Queen's Own) Royal West Kent Regiment, receiving new colours in 1827 from Queen Adelaide, then Duchess of Clarence, the old colours, which had been carried in the Peninsula, were cremated and the ashes preserved in a box forming part of the mess plate. On the box are engraved the names of those who fell bearing the colours in action (4). On the disbandment of the 2nd Battalion of the 34th in 1817, the colours carried during the Peninsula War were handed over to the 1st Battalion, and kept by them for many years. It was at length decided to preserve them in a glass case, and they were sent for that purpose in 1857 to a tradesman residing in the Opera Colonnade, in London; but the establishment was burned down when Her Majesty's Opera House was destroyed by fire, and the charred remains were all the 34th recovered of their old Peninsula colours (5).

It was in connection with the disastrous surrender at Saratoga in 1777 that the colours of the 9th, now the Norfolk, Regiment were preserved by an artifice, original in its ingenuity, if not quite in accordance with the rules of war. Lieut.-Colonel Hill removed the colours from the staves and concealed them in his private baggage, which he was permitted to retain. When the regiment returned to England in 1781, he produced the colours and presented them to George III., who, far from censuring his conduct, praised his acuteness and faithful service by appointing him one of his aides-de-camp (6). Concealed with equal care amongst the Colonel's baggage were the colours of the 2nd New Hampshire Regiment, which the 9th had, only a few months before, captured from the Americans at Wood Creek (7).

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(1) Military Extracts, Royal United Service Institution.

(2) Cannon's Records of the 74th Highlanders, p. 104.

(3) Ross's Scottish Colours, p. 68.

(4) *Broad Arrow*, 24th November, 1894.

(5) Noakes's History of the 34th and 55th Regiments, p. 61. It is believed that the ashes were preserved and placed in a silver urn in the officers' mess. —R. H.

(6) An illustration of these colours is given in Mr. Milne's book, pp. 106-8.

(7) These American colours are still preserved in the Hill family.

THE Americans were very much incensed at what they considered a violation of the conditions of surrender, by so many regiments failing to hand over their colours. There does not appear to be any fixed rule with regard to colours in cases of surrender or capitulation (1); but it is certain that no higher compliment can be paid a vanquished foe than to permit him to retain them. In the Convention of Saratoga, colours were not mentioned. In the American War of Independence the English officers viewed their foes more in the light of rebels than an ordinary enemy, and, therefore, not entitled to the same courtesy; and, again, the colours were practically the private property of the Colonel, and not Government stores. On one occasion during the conquest of Canada, a French garrison consisting of several regiments was captured, but the colours were nowhere to be found. When the surrender was inevitable, the Commandant ordered them all to be destroyed (2). When the Garrison of Minorca, which Admiral Byng failed to relieve, consisting of the 4th, 23rd, 24th, and 34th regiments, surrendered to Marshal Richelieu, on 28th June, 1756, the following conditions were inserted in the Articles of Capitulation:—"The noble and vigorous defence which the English have made, having deserved all the marks of esteem and veneration which every military man ought to show to such actions, and Marshal Richelieu being desirous also to show to General Blakeney the regard due to the defence he has made, grants to the garrison all the honours of war they can enjoy under the circumstances of going out for an embarkation—to wit, firelocks on their shoulders, drums beating, colours flying, twenty cartridges each man, and also lighted match." It is pleasing to be able to record that an opportunity occurred in 1777 for the English to repay this graceful compliment to their valour, for in acknowledgment of the gallant defence made by the French at Pondicherry under M. Bellacombe, the colours of the garrison were immediately restored by the British.

PERHAPS no more fitting method of terminating a life of honourable active service on the part of the colours of a regiment can be found than that of consigning them to the grave with full military honours. The instances are extremely rare, though one exists in the case of the 25th (Edinburgh) Regiment, now the King's Own Scottish

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(1) Mackay's regiment, subsequently incorporated with the corps now known as the Royal Scots, lost its colours at Lauenburg when it surrendered to a superior force under Count Tilly in 1627. The regiment was permitted to march out with bag and baggage, but the commanding officer had omitted to include the colours, which, under protest, were taken from him. For this oversight he was dismissed the regiment with disgrace. The colours were of peculiar interest, as the regiment originally carried the Cross of St. Andrew on them, but was afterwards compelled to bear the Danish Cross also, in deference to the King of Denmark, in whose service they were.—*Mackay's Regiment*, pp. 8 and 15. Published privately at Inverness, 1879.

(2) Ross's Scottish Colours, p. 68.

Borderers, which, when commanded by Lord George Lennox, buried theirs at Newcastle-on-Tyne, in 1763. The colours, which had been in use for many years and were quite worn out, are supposed to have been carried at Fontenoy, Culloden, Roucoux, Val, Minden, Campen Fellinghausen, and Wilhelmsthal (1). When the 36th Regiment, now the 2nd Battalion Worcestershire, received new colours in 1799, the old set, carried with such distinction at Seringapatam, Bangalore, Nundydroog, and Pondicherry, were buried with ceremony at Winchester (2). A curious tradition prevails in the 93rd, now the 2nd Battalion of the Argyll and Sutherland Highlanders, that when Lieut-Colonel Robert Dale was mortally wounded in command of the regiment at New Orleans, in 1815, his dying wish was that he might be buried in one of the colours, which request is supposed to have been complied with; and it certainly is a coincidence that while the King's colour is framed and still preserved by the officers, its companion is missing (3). It was a beautiful idea, for no more appropriate shroud could be devised for a brave soldier; but it is well to remark that the late Rev. C. R. Gleig, Chaplain General to the Forces, who served as a subaltern in the campaign, and remembered the incidents well, saw the 93rd inspected in the Isle Dauphin, three months after the battle of New Orleans, and he was positive that both colours were on parade. The absence of either of them would not have escaped notice, and he was very convinced as to seeing both the colours with the regiment (4).

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(1) Higgins's Records of the 25th King's Own Scottish Borderers, p. 143.

(2) Correspondence of Captain Vernon, 36 F., with the Herald's College, in 1810.

(3) Burgoyne's Records of the 2nd Battalion Argyll and Sutherland Highlanders. Appendix D, p. 430.

(4) Mr. Milne, author of Standards and Colours of the Army, to whom the late Mr. Gleig made the statement, is my informant.—R.H.

NOTES ON THE LEE-METFORD RIFLE. (Mark II.)

By Major C. B. MAYNE, R.E., and Capt. C. F. CLOSE, R.E.

Preface.

In the body of these Notes only bare results and formulæ are given. The methods, mostly elementary, by which the results and formulæ have been arrived at are shown in the appendices at the end of the paper.

The preparation of these Notes has been rendered possible by the publication of the Report of the S.A. Penetration Committee of 1893-94. This Report gives the results of actual experiment, and the deductions given in this paper are all the more worthy of credence as the Committee's experiments were made for another purpose, and not with any idea of obtaining data for the matter here dealt with.

The thanks of the joint Authors of these Notes are due to Mr. J. Rigby, M.A., Superintendent of the R.S.A. Factory, Enfield, Captain F. F. Fisher, R.A., and Captain J. Cowan, R.E., for their kind assistance in giving additional information when required. But none of these gentlemen are in any way responsible for the results deduced from, and opinions based on, the information they have so kindly given.

These Notes might have been made more useful had certain data and statistics been procurable. But as these data and statistics are non-existent, the following paper has been written from the best data available, *i.e.*, data based, wherever possible, on actual experiments and practice.

1.—Statistics concerning the Rifle and its Ammunition.

(*a*) *Rifle.**—Weight of rifle (magazine empty), 9 lbs. 4 ozs.
Weight of sword (without scabbard), 15 ozs.
Length of magazine capacity, 10 rounds.
Twist of rifling, 1 turn in 10 inches, to the left.
Sighting, 200 to 1,800 yards on leaf sight; 1,600 to 2,800 yards on dial sight.
Diameter of bore of rifle, 0·303 inch.

(*b*) *Bullet.*†—Length of bullet, 1·25 inch.
Maximum diameter of bullet, 0·311 inch.
Weight of bullet, 215 grains ± 3 grains.
Material of bullet, 98 per cent. of lead and 2 per cent. of antimony.
Nature of envelope of bullet, cupro-nickel formed of 80 per cent. of copper and 20 per cent. of nickel, with 0·5 per cent. of iron added.

* See also *Musketry Instruction, 1894* (Lee-Metford), p.p. 171, 172.

† See also *Musketry Instruction, 1894* (Lee-Metford), p. 178.

(*c*) *Charge.*—Cordite, 31 grains ± 1 grain.

(*d*) *Case.*—Solid-drawn brass.

(*e*) *Velocity of bullet.*—By the manufacturing specification, the velocity obtained with the above rifle and ammunition is to be 1,950 f.s. at 90 feet from muzzle ± 40 f.s.

This value gives a muzzle velocity of about 2,008 f.s. ± 41·5 f.s.

In warm weather the muzzle velocity is greater than in cold weather, but no rule can be given as to ratio of muzzle velocity to temperature.

The muzzle velocity not only varies with different batches of ammunition, but also varies in the same batch. The S.A. Penetration Committee found that the same brand of cordite gave muzzle velocities varying by nearly as much as 100 f.s. It is not yet known how much of these variations is due to the ammunition, to the velocity-measuring instrument, to the rifle, or to external causes.

(*f*) *Weight of ammunition.*—A single cartridge weighs about 414 grains.

Weight of a packet of 10 cartridges, 9⅝ ozs.

Weight of S.A.A. box, empty { Mark XI. G.S., 12 lbs. 4 ozs. / Mark XIV., H. & S., 11 lbs.

Weight of S.A.A. box, full { Mark XI., G.S., 78 lbs. 6 ozs. / Mark XIV., H. & S., 76 lbs. 10 ozs.

Number of rounds in a S.A.A. box, 1,100.

(*g*) *The drift of the bullet*, due to the rifling, is about 1 foot at 1,000 yards and 1·5 foot at 1,200 yards. No allowance is made for this in the sighting as it is so very small, and is practically inappreciable if we consider the much larger effects produced by any wind on the bullet.

(*h*) *Size of shot groups.*—No accurate experiments have been made to obtain statistics on this point, but the average deviation, called the "Figure of Merit," of 20 rounds, from the point of mean impact at 500 yards, is not to exceed 9 inches when fired from a rest. In practice the figure of merit is generally considerably less than this. It is considered "good" if all the shots are put in a circle, 1 foot in diameter, at 500 yards, and also in a circle of 3 feet in diameter, at 1,000 yards. (The errors of a good shot when the rifle is held at the shoulder may be taken at twice these values.)

The Lee-Metford has a vertical upward "jump" of about 9′ with Mark I., and of about 11′ with Mark II. It also has a slight horizontal side jump to the left when fired from the right shoulder, to correct which the foresight is placed 0·05 inch to the left of the axis. There is no horizontal side jump when the rifle is fired from the left shoulder. As regards the upward jump, it may be stated that it was ascertained with the aid of a fixed rest, but in reality the shoulder of a soldier is not a fixed or stable point, but gives way to the recoil of the rifle. Consequently, when fired from the shoulder, much of the energy of recoil is used up in driving the rifle bodily backwards instead of being used up in making the

rifle rotate about the point that the butt rests against when the rifle is fired. Hence, the practical jump is less than that stated above.

In calculating the ranges, ordinates, etc., of the rifle, we have to make use of the factor $\frac{d^2}{w}\sigma$, where d is the calibre of the rifle in inches, w the weight of the bullet in lbs., and σ is a factor depending on the shape of the head, smoothness of the surface, etc., of the bullet. The value of $\frac{d^2}{w}$ for the Lee-Metford is 2·98913. The only difficulty is the value to be assigned to σ. The value usually given to it is 0·7, but to make the calculated data agree with the experimental data given by the S.A. Penetration Committee, σ should be given the value 0·80 (*see* Appendix III.), and, therefore, the value of $\frac{d^2}{w}\sigma$ is 2·3913.

2.—Experiments.

The following pages are based on the results of the experiments of the Small-Arms Penetration Committee, carried out in 1893-94, with cordite ammunition. Before deducing any general results it is advisable to examine the accuracy of these experiments.

First, as regards elevations, ranges, and angles of drop. These are affected by wind, variations in muzzle velocity, and density of air.

Wind.—The following table of the winds experienced on the different days of firing shows that, so far as concerns this source of error, there is only one range (1,500 yards) which is likely to give unreliable results :—

Range	Wind
1000 yards ..	slight
1500 ,,	strong and gusty
	very strong
2000 ,,	moderate
	strong
	moderate
2500 ,,	slight
	moderate
	very slight
	moderate
3000 ,,	very slight
	slight
	moderate
	slight
3500 ,,	very slight
	nil
	slight
	fairly strong

It would have been easy to make corrections for wind if its strength and exact direction on each day had been given in the report. It may,

however, be taken that the wind has not much affected the mean results, except at the 1,500-yards range.

Variations of muzzle velocity.—In round numbers, the muzzle velocities obtained from April to October, 1893, varied from 1,900 f.s. to over 2,000 f.s. The mean muzzle velocity was 1,962 f.s. This is considerably below the present mean service velocity, which is 2,008 f.s., but is nearly the same as the present stipulated minimum velocity (1,968 f.s.).

Variations in muzzle velocity are a serious source of error. For instance, if the rifle is sighted for 2,008 f.s. and the actual muzzle velocity is only 1,962 f.s., then, at a range of 2,000 yards, the bullet will pass 12 feet below the object, and the error in range will be 25 yards.

However, as this is a source of error which we shall always have with us, and is not, apparently, likely to diminish in the near future, it does not affect the practical value of the experiments, especially as a sufficient number of rounds were fired to cause the mean muzzle velocity of each range to approximate to the mean muzzle velocity of the whole.

Variations in density of air.—The mean barometer and thermometer (dry) readings were as below:—

Range, Yds.	Barometer	Thermometer F.
1000	29.8 inches	53°
1500	29.9 ,,	57
2000	29.8 ,,	51
2500	30.0 ,,	50
3000	30.1 ,,	53
3500	30.3 ,,	48

The variations of barometer and thermometer were small. The mean reading of barometer is 29·96 inches, and of thermometer 52° F.

These correspond to a factor $\tau = 1{\cdot}016$.*

It has not been thought worth the trouble to correct each range for these readings, as the corrections are small and there is a good deal of uncertainty as to strength of wind and value of mean muzzle velocity at each range.

Reasons for choosing 1893 experiments.—It is obvious that with the variations pointed out above, it is very desirable to base general results on data furnished by as large a number of rounds as possible. In this respect the 1893 experiments are greatly superior to those of 1894, which have, therefore, been left alone. Where necessary, however, corrections have been applied to bring results to the standard of the 1894 velocity (2,008 f.s.).

Accuracy of experiments.—The variations in range are not reported, and it is assumed that the elevations (which were taken with a clinometer, the rifle being so fixed in a rest that it could not jump) are correct to within 1′.

* Text Book of Gunnery, 1887, p. 305.

As regards angles of drop, the following will give an idea of their reliability:—

1,000 yds.	Probable error of a single observation					4′
1,500 ,,	,,	,,	,,	,,	,,	15′
3,000 ,,	,,	,,	,,	,,	,,	15′

which are more than good enough.

The times, which were taken with a stop-watch, may be taken as correct to within a tenth of a second, so far as observation goes. See Appendix III.

Degree of Accuracy required in Musketry Calculations.

Elevations.—For practical purposes there is no need to work out elevations to greater accuracy than the back sight can be adjusted to. A minute of elevation is equivalent to $\frac{1}{150}$-inch on the flap sight. Sights are not usually set with this accuracy, and the thickness of the graduations is about 3′; and, again, the amount of foresight used cannot be judged to one minute of elevation, the full foresight giving about ten minutes' elevation. There is, therefore, no need to provide tables or formulæ which work beyond the nearest minute. It is preposterous to work out tables, as has been done, to seven places of decimals of a minute. An error of a minute at 2,500 yards causes an error in range of two yards, and at 1,000 yards, seven yards. Variations in wind, muzzle velocity, and density of air produce errors many times this size.

Ranges.—Generally speaking we may say that if ranges are obtained from formulæ to within ten yards of the truth, they are good enough for use.

Angles of Drop.—Angles of drop, measured usually by the cotangents, will be sufficiently accurate if the whole numbers are correct, except at extreme ranges; *e.g.*, at 1,500 yards, experimental angle of drop is 1 in 10·8, say 1 in 11.

Times.—Times, as usually measured with a stop-watch, cannot be relied on beyond the tenth of a second.

Atmospheric Conditions.—The following investigations do not deal with corrections required for variations in the density of the air as measured by barometer and hygrometer.

3.—General Formulæ Connecting the Ranges, Elevations, and Angles of Drop of the 1893 Experiments.

Ranges and Elevations.—It is a mistake to suppose that any simple formula can be deduced from experiments, which is of any value beyond the range of the experiments. Within the limits of any experiments, however, useful empirical formulæ can be deduced from them for the weapon in question; and these formulæ may be applied to any unobserved values within those limits.

Angles of Elevation.—The following table shows the mean values of the angles of elevation for the Lee-Metford, from the 1893 experiments, for muzzle velocity 1,962 f.s.

Range, Yards.	Angle of Elevation (in minutes)	
1000	93	
1500	196*	*This value is probably about 14′ too large (See previous remarks on *Wind.*)
2000	309	
2500	506	
3000	863	

The third differences of these angles are nearly equal, and it can be shown that the following expression gives the value of E, the angle of elevation in minutes:

$$E' = 0{\cdot}1\, r^3 - 4{\cdot}3\, r^2 + 80{\cdot}6\, r - 383 \qquad (A)$$

where $r = \frac{\text{range in yards}}{100}$

As the above expression is rather long, and of questionable accuracy, owing to the inaccurate value for 1,500 yards, the following empirical formula may be used:—

$$E' = \frac{16033}{42{\cdot}7 - r} - 397 \qquad (B)$$

The following table shows the values by experiment and by formula (B):—

Range	E, by experiment	E, by formula (B)
1000	93	93
1500	*196 strong wind against bullet	*182
2000	309	309
2500	506	506
3000	863	865
3500	1636 very variable	1685

With the exception of one range (1,500 yards) in which the conditions were not favourable to accuracy, experiment and formula agree.

These elevations are clinometer elevations; the rifle was fixed in a rest and no jump was possible. As the rifle, when held against a fixed object, jumps upwards about 10′, the formula (B) becomes:—

$$E' = \frac{16033}{42{\cdot}7 - r} - 407 \qquad (C)$$

and this formula is recommended for use with muzzle velocity of 1,962 f.s.

Example.—What is the elevation for 2,700 yards, with 1,962 f.s. muzzle velocity?

$$E' = \frac{16033}{42{\cdot}7 - 27} - 407 = 615' \text{ or } 10^\circ\ 15'$$

* The difference between 196′ and 182′ would be due to wind of about 30 miles an hour.

Angles of Descent.—The experimental values of these angles obtained in 1893 for muzzle velocity 1,962 f.s., are:—

Range, yards.	Expt. Drop 1 in	Formula (D) Drop 1 in
1000	22·8	22·4
1500	10·8	11·2
2000	6·0	5·6
2500	3·0	2·8
3000	1·4	1·4
3500	0·7	0·7

If the experimental values are slightly altered to the series shown in third column, then

$$\left.\begin{array}{l}\cot. D = \\ \text{or drop} = 1 \text{ in}\end{array}\right\} 0{\cdot}7 \times 2^{\frac{3500 - \text{Range}}{500}} \qquad \text{(D)}$$

which can be used for all ranges up to 3,500 yards.

Example:—What is the drop at 3,500 yards?

$$\text{Drop} \quad 1 \text{ in } 0{\cdot}7 \times 2^{\frac{3500 - 3500}{500}}$$

$$= 1 \text{ in } 0{\cdot}7$$

Another formula for muzzle velocity 1,962 f.s. can be obtained from (B). See Appendix I.

$$\text{Drop} = 1 \text{ in } \frac{(42{\cdot}7 - r)^2}{4{\cdot}65\, r} \qquad \text{(E)}$$

4.—Empirical Formulæ for Present Mean Muzzle Velocity.

Range and Elevation.—The formulæ given above are based on the 1893 experiments, when the mean muzzle velocity was 1,962 f.s.

Now when muzzle velocity = 2,008 f.s. it can be shown* that,

$E' + 2'$ gives a range of $(35 + R)$ yards,

and the old formula $E' = \dfrac{16033}{42{\cdot}7 - r} - 397$ - - for m.v. 1,962 f.s.

becomes $E' = \dfrac{16033}{43 - r} - 395$ - - for m.v. 2,008 f.s.

or allowing for a jump of 10′ (†)

$$E' = \frac{16033}{43 - r} - 405 \qquad \text{(F)}$$

which should be used with the present service velocity.

The allowance for variations of ± 40 f.s. in muzzle velocity is $\mp \dfrac{r^2}{50}$ minutes, respectively; this gives an idea of the limits of elevation for a given range due to variations in muzzle velocity alone.

* See Appendix V.

(†) As the shoulder is not a fixed object, practically the jump is less than 10′, the exact amount varying with each individual, and with the degree in which he fears the recoil.

Angles of Descent.—The formula for these with m.v. = 2,008 f.s. becomes

$$\text{Drop} = 1 \text{ in } \frac{(43-r)^2}{4{\cdot}65r} \qquad (G)$$

These angles of drop are very much modified by the wind. In the experiments of 1893, at 1,500 yards the drop in one case was 1 in 14, and for the next round was 1 in 9; the mean drop being about 1 in 11.

Angles of Elevation.—Comparison of formulæ, with experiment, and actual graduation of rifle.

Elevation in Minutes.

Range, Yards.	Experiment 1893 for 1,962 f.s. —10′ jump.	Formula $\frac{16033}{42.7-r}-407$ for 1,962 f.s.	Sighting of Rifle by measurement *	Formula $\frac{16033}{43-r}-405$ for 2,008 f.s.
1000	83	83	87	81
1500	186†	172	174	168
2000	299	299	303	292
2500	496	499	504	486
3000	853	855		828

In the above formulæ the jump has been taken as the experimental one of 10′. As a matter of fact, when the rifle is fired from the shoulder, the jump is variable, and probably averages less; so that the sighting of the rifle may be taken as good for the minimum velocity. In fact, if we take the jump as 6′ instead of 10′, *i.e.*, if we add 4′ to the numbers given in the 2nd, 3rd, and 5th columns of the table, we find that the rifle elevations in the 4th column are in very close agreement with the formula for muzzle velocity 1,962 f.s. and the 1893 experiments. For the supposed average velocity (2,008 f.s.), the rifle is therefore somewhat over-sighted. Beyond 2,500 yards the sighting of the rifle is unreliable, but this is a matter of small importance.

The dial sights are somewhat coarse, and the aperture of the back sight too large. With such sights errors of at least 5′ of elevation are to be expected, giving vertical errors of, say, 10 feet, and horizontal errors of 20 yards, at a range of 2,000 yards.

Formulæ for elevation are not of much use, unless it is intended to go in for deliberate long-range fire. They may, however, be of great value in siege operations.

* These elevations are correct to within 1′ or 2′, and are therefore only near approximations. Nothing would have been gained by more accurate measurements.

† Unreliable, from the unfavourable conditions under which it was ascertained. Its probable value is about 172′.

5.—Effect of Wind.

It is clear that the lateral effect of wind on a long, thin bullet, like the Lee-Metford, must be considerable, and that the longitudinal effect will not be so great as upon a bullet of less sectional density. It would be possible to investigate the effect of a side wind on this bullet, but as the investigation could be of no practical use, it will not be attempted.

It is, however, of some slight practical use to obtain an idea of the effect of a longitudinal wind; *i.e.*, a wind up or down the range, which cannot be allowed for by wind-gauge, but for which the sights must be altered. The rule which follows will also serve to give an idea of the variations to be expected from this cause.

If v is the velocity of the wind,
R the normal range in still air at any elevation,
R' the range due to a muzzle velocity of normal velocity $+ v$,
t the time of flight,
If the wind is *against* the bullet, then
Loss of range $= v\,t - (R' - R)$ See Appendix II.

From this the following rough rule can be deduced. See Appendix II.

$$\text{Loss in range} = \frac{vr}{7}* \qquad \text{(H)}$$

where v = velocity of wind in miles an hour

$$r = \frac{\text{range in yards}}{100}$$

Formula (H) gives results too large for small values of $v\,r$.

When the wind is *with* the bullet the same formula applies to the gain in range for a given elevation.

Example:—What sights should be used for a 2,000-yards range, with a contrary wind of 30 miles an hour?

$$\text{here } \frac{v\,r}{7} = \frac{20 \times 30}{7} = 86.$$

Put the sights up to slightly under 2,100 yards.

The maximum range obtained during the experiments was 3,760 yards, with 29° elevation and a strong rear wind. In a perfect calm a range of 3,500 yards was obtained with an elevation of about 28°; allowing for the difference of 1° between the two cases, there is a discrepancy of about 200 yards due to wind, which shows there was a mean wind of between 30 and 40 miles an hour; a not improbable result, considering that the bullet rises to a height at which the strength of wind is greatly increased owing to decrease of earth friction.

The extreme range of the Lebel rifle has been put down as 3,850 yards, with an angle of elevation 32°.

*Or more accurately, $\frac{vr}{7} - \frac{v}{2}$

6.—Dangerous Zones.

The only way of calculating the trajectories of the bullet for different ranges with any approach to accuracy is by the use of elaborate formulæ and tables such as Bashforth's. The usual method of obtaining ordinates by the *vacuo* formula, ordinate in feet $= \frac{1}{2} g t (T-t)$, is a very inaccurate one when applied to trajectories in air, as it gives much too small a value for the ordinates.

Given the angles of elevation for different ranges, then, probably the most convenient formula for finding the ordinates of the trajectories is the following one, much used abroad, viz.:—

Let y the ordinate for the distance x

ϕ_R the angle of elevation for the whole range

ϕ_x the angle of elevation for the range x

Then if x and y are expressed in feet—

$$y \text{ feet} = \frac{x}{2 \cos.^2 \phi_R} \left\{ \sin. 2\phi_R - \sin. 2\phi_x \right\}$$

or, for the shorter ranges, the following approximation may be used:—

$$y \text{ feet} = x (\tan. \phi_R - \tan. \phi_x)$$

Using this formula to find the ordinates at points 100 yards and under from the end of each range, and then plotting these and finding when the trajectory descends to 6 feet from the line of sight, the dangerous zones for each range can be found. Those for the Lee-Metford can be approximately expressed, for ranges over 800 yards, by the formula:—

$$\text{Dangerous zone in yards for Infantry 6 feet high} = \frac{1020}{r} + r - 60$$

where $r = \frac{\text{range in yards}}{100}$

Similarly for Cavalry, 8 feet high, we have—

$$\text{Dangerous zone in yards} = \frac{1320}{r} + r - 72$$

$$= \text{Dangerous zone for Infantry} + \left(\frac{300}{r} - 12 \right)$$

The chief object of knowing the ordinates of the different trajectories is to ascertain the dangerous zones, and to know how far it is safe for Infantry to fire over the the heads of other troops. No attempt has been here made to work out the trajectories of the Lee-Metford for different ranges, for if the truth be told, a knowledge of the trajectories (that is, a knowledge of the heights of all the ordinates) is in itself of little practical use, except in very exceptional cases.

7.—Firing Up and Down Hill.

(See Appendix IV).

There can be no simple expression for the elevation required for firing at a given range up or down hill; it is clear that the question is the inverse of that of finding the ordinates of a trajectory; and there is no simple formula for working out these, but each case must be worked out for itself.

The method of finding the proper sighting for various ranges up and down hill is shown in Appendix IV. The method is a very obvious one, and depends entirely on Bashforth's formulæ.

The following is a list of some ranges and elevations that have been worked out :—

Up Hill.

1	2	3	4	5
Slope of Hill	Range on Slope	Range on Plan	Sight for	Difference between columns 4 and 3
$24\frac{1}{2}^\circ$	2184	1988	2014	+26
$16\frac{3}{4}^\circ$	1618	1549	1551	+ 2
10°	1905	1841	1822	—19

Down Hill.

$3\frac{1}{2}^\circ$	1621	1618	1576	—42
7°	1131	1122	1117	— 5

There is no particular use in multiplying examples, which involve a good deal of labour. It is clear that there is no simple law such as rough methods might appear to give, but that the range on plan and true sighting do not differ greatly.

Therefore, in firing up or down hill, sight for the range on plan. The same result can be arrived at by using the formula quoted previously,

$$\text{viz. : } y = \frac{x}{2\cos^2\phi_R}\{\sin 2\phi_R - \sin 2\phi_x\}$$

Let $\phi_R = 14^\circ\ 25'$

and let x be 1,000 yards or 3,000 feet,

then $\phi_x = 93' = 1^\circ\ 33'$,

whence $y = 684{\cdot}71$ feet.

And slope of hill $= \tan.^{-1}\frac{y}{x} = 12^\circ\ 51'$, and rifle must be sighted for $(14^\circ\ 25' - 12^\circ\ 51')$ or $1^\circ\ 34'$ which is $1'$ greater than the elevation for 1,000 yards; that is, use the sight for the range on plan.

Similarly, if the slope of hill is $28^\circ 5'$, the same result is obtained. This is the case of firing at the top of a hill about 1,500 ft. high, from a point about a thousand yards distant on plan; this would be very nearly the same as firing up the Rock of Gibralter from the west side.

8.—Summary of Results.

Formulæ.

Let $r = \frac{\text{range in yards.}}{100}$

1.—$E = \frac{16033}{43 - r} - 405$ (assuming a jump of 10′) for m.v. 2008 f.s.

2.—Drop=1 in $\frac{(43-r)^2}{4{\cdot}65\,r}$

Or drop=1 in $0{\cdot}7\times 2^{\frac{35-r}{5}}$

These may be used up to the extreme range, but are much affected by wind.

3.—Dangerous zone in yards =

$$\frac{1020}{r} + r - 60 \text{ for Infantry 6 feet high}$$

and $= \frac{1320}{r} + r - 72$ for Cavalry 8 feet high

4.—The gain or loss in range (in yards) due to a wind of v miles an hour, up or down the range $= \frac{v\,r}{7}$

5.—Firing up or down hill, sight for the range on plan.

With regard to the foregoing, generally speaking, formulæ for elevation expressed in powers of r, such as formula (A) *p.* 46, pretend to a greater degree of refinement than is justifiable. It is to be noted that the formulæ suggested for use are only the empirical representations of the results of *actual* experiment, and will not apply to any other rifle or bullet than the Lee-Metford M. II. and present bullet.

No experiments have been made to ascertain the shot groupings of the Lee-Metford.

Attention is here drawn to the fact that less coarse long-range sights would be an advantage, and it appears that the present long-range sights for the extreme ranges are inaccurate.

APPENDIX I.

The following gives the relation between angles of elevation and descent. (*See Fig.* 1.)

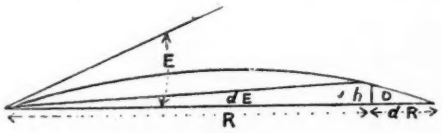


Fig. 1.

Let h be any small height above the horizontal plane.

Let dE and dR represent increments in E and R respectively.

Then $h = R \tan. dE = R\,dE \tan. 1'$

also $h = dR \tan. D$

therefore $dR \tan. D = R\,dE \tan. 1'$

and $\tan. D = R\,\frac{dE}{dR} \tan. 1'$

From this formula it appears that, if any equation (even empirical) can be found connecting E and R, the angles of descent can be computed.

Example:—From formula (B)

$$E' = \frac{16033}{42{\cdot}7 - r} - 397$$

whence $$\frac{dE}{dr} = -\frac{16033}{(42{\cdot}7 - r)^2}$$

therefore tan. $D = r\frac{dE}{dr}$ tan. 1′

$$= -\frac{16033 \times r \text{ tan. } 1'}{(42{\cdot}7 - r)^2}$$

or, cot. $$D = -\frac{(42{\cdot}7 - r)^2}{4{\cdot}65\ r} \qquad \text{(E)}$$

Range, Yards	Drop by experiment, 1 in	Drop by formula (E) 1 in
1000	22·8	23·0
1500	10·8	11·0
2000	6·0	5·6
2500	3·0	2·7
3000	1·4	1·2

The formula (E) is thus good enough for practical purposes, for muzzle velocity 1,962 f.s.

APPENDIX II.

Effect of Wind.

The lateral effect of wind need not be considered, as it is easily allowed for.

Longitudinal effect of wind.—First. Take the case of a wind blowing against the bullet, the elevation of the rifle being small, say under 10°.

Let v be the velocity of the wind.
V ,, muzzle velocity of the bullet.
R the range due to V in still air.
R' ,, ,, $V+v$ in still air.
t the time of flight.

At the instant the bullet leaves the rifle, its velocity with reference to the wind is $V+v$.

Now, with reference to the moving mass of air, the bullet describes a perfectly regular trajectory, and attains a range R' due to a muzzle velocity of $V+v$, which range can be calculated by Bashforth's tables.

But all this time the air has been moving at a velocity v, and has gone backwards a space, vt. Hence the range actually attained $= R'—vt$, and the *loss* of range due to the wind is $R-(R'-vt) = vt-(R'-R)$.

Second. This formula also applies to a wind *with* the bullet, with the signs altered. In this case R' is the range due to a velocity of $V - v$. The range attained $= vt + R'$. Gain $= vt + R' - R$.

Example.—Particular cases are easily worked out, *e.g.*:—What is the loss of range caused by a 27-mile wind, rifle sighted for 2,500 yds.? Elevation $= 506'$. Muzzle velocity $= 1{,}962$ f.s. $V + v = 2{,}002$ f.s. Time of flight approximately is 10 seconds.

$$vt = \frac{27 \times 1760}{60 \times 60} \times 10 = 132 \text{ yds.}$$

R' can be worked out (say by Niven's method).
and $= 2{,}533$ yds.
R by assumption $= 2{,}500$,,
$R' - R =$ 33 ,,
and loss $= vt - (R' - R) = 132 - 33 = 99$ yds.

Rough Formula.—The loss or gain, due to winds of the same velocity, against or with the bullet, may be considered the same, where great accuracy is not required.

Considering the formula—

$$\text{Loss or gain} = v\,t - (R' - R)$$

The times of flight, to nearest second, for ranges 500 to 2,000, are:—

500	yards	..	1 second
1,000	,,	..	3 ,,
1,500	,,	..	5 ,,
2,000	,,	..	7 ,,

or $t = \frac{4r - 10}{10}$ and therefore $v\,t = \frac{v\,(4r - 10)}{10} \times \frac{1760}{3600}$

where v is velocity of wind in miles an hour, r is in hundreds of yards.

The part $R' - R$ can only be roughly approximated to, but it is always much smaller than $v\,t$.

A rough rule is $R' - R = .06\,v\,r$.

Hence loss $= .20\,v\,r - .49\,v - .06\,v\,r$.
$= .14\,v\,r - .49\,v$
$= \frac{v\,r}{7} - \frac{v}{2}$ nearly

Hence it will be good enough for a working formula to take

$$\text{Loss or gain} = \frac{v\,r}{7} \text{ for the Lee-Metford (§).}$$

If the elevation of the rifle is great, say 20°, the process is the same, except that R' is the range due to $V + v \cos. 20°$. All the rest is the same, and particular cases can be easily worked out accurately, though it is hardly worth the trouble, as the rough rule above is quite good enough for practical purposes.

(§) It is obvious that the loss can never be greater than $\frac{v\,r}{5} - \frac{v}{2}$, so that the formula sometimes quoted, $\frac{v\,r}{4}$, is incorrect for the Lee-Metford.

APPENDIX III.

Determination of σ.

In order to apply Bashforth's tables for working out trajectories, velocities or times, for any given projectile, a factor σ has to be used, which depends on the smoothness of surface, shape of head, and steadiness in flight of the projectile.

Then, for the present, neglecting variations in the density of the air,

resistance $\propto \frac{d^2}{w} \sigma$

and σ must be found from the experiments.*

Let R be any range for a given elevation calculated by Bashforth's tables (say by Niven's method) with an assumed value of $\sigma = \sigma_1$.

Let R_e be the range for the same elevation found by experiment.

Then $\sigma = \sigma_1 \frac{R}{R_e}$

The following table shows the results of some of these calculations:

σ_1	R	R_e	σ
·80	1010	1000	·81
·80	1551	1555	·80
·85	1822	1893	·82
·82	2014	2055	·80
·81	2478	2500	·80

whence mean $\sigma = ·806$.

As a rough check on this,

if t' = time over range by experiment,

and t = calculated time, with no factor,

then $\sigma = \left(\frac{t'}{t}\right)^2$

Range	$\frac{t'}{t}$	$\left(\frac{t'}{t}\right)^2 = \sigma$	
1000	·93	·85	
1500	·91	·83	
2000	·86	·74	mean σ = ·79
2500	·85	·72	
3000	·91	·83	

This is sufficiently near, as the times are but roughly measured, to show that time is no serious error in the first value.

From above $\sigma = ·806$.

* See Text Book of Gunnery, 1887 p 140.

Now this is the mean σ for the 1893 experiments, uncorrected for variation of barometer and thermometer from standard of 30 inches and 60° F.

During experiments mean B = 29·96 inches.
and mean T = 52° F.
*whence τ = 1·016
But $\sigma\tau$ = ·806
whence σ = ·80

And this value of σ should be taken for calculating the trajectories, times and velocities of the Lee-Metford. †

Times.—If σ for the experiments is taken as ·81
the true times = times calculated without $\sigma \times \sqrt{\sigma}$
or $\times$ ·9

The following is a list of times calculated with no coefficient for muzzle velocity of 2,000‡ f.s.

Ranges	Times (no co-efficient)	Times × ·9	Observed Times
1000 yards	2·70 secs.	2·43	2·5
1500 ,,	4·89 ,,	4·40	4·5
2000 ,,	7·76 ,,	6·98	6·65
2500 ,,	11·52 ,,	10·37	10·13
3000 ,,	16·37 ,,	14·73	14·96

Which shows that the observed times are fairly good, allowance being made for wind.

APPENDIX IV.

Firing Up and Down Hill.

Let A P be any hill, of angle θ. A the firing point. (*See Fig.* 2.)

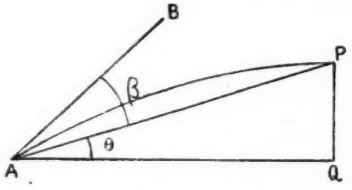


Fig. 2.

*Text Book of Gunnery, p 305.

† There is a possibility of some confusion as to this value of σ. It is the value which should be used with the Bashforth's Tables published in the "Text Book of Gunnery, 1887." If, however, for any purpose, it is desired to compare the bullet with a hemispherically-headed one, for which σ = 1, then σ = ·65. But this latter value is *not* to be used with the tables referred to.

‡Variations in muzzle velocity effect times slightly.

Let the rifle be fired at an angle of elevation QAB = α. Then if θ is known, we know the value of $\beta = \alpha - \theta$; that is, to hit P the rifle must be sighted for an angle β. Now we know what range β will produce on the level. Hence to hit P the rifle must be sighted at such a range as is given by β on the level.

Example :—

Let $\alpha = 20^\circ$ ($\sigma = \cdot 80$).

Then, by Niven's method, after the trajectory has flattened down 10° (or any other convenient angle),

$\theta = 16^\circ 44'$, AQ = 1,549 yards.

whence $\beta = 3^\circ 16'$

Now (by Niven's method or any other) this angle 3° 16′ on the level, produces a range of 1,551 yards.

Also range on slope AP = AQ sec $16^\circ 44' = 1{,}618$ yards. Hence to hit a point P, distant 1,618 yards along an upward slope of $16^\circ 44'$, sight for 1,551 yards.

Firing down hill can be treated in the same way.

APPENDIX V.

The Effect on Range of Variations in Muzzle Velocity.

Example :—Variations from 1,962 to 2,008 f.s.

1st, it can be shown in the usual way that if the muzzle velocity is 2,008 f.s., then after the bullet has moved 71 feet the velocity will be 1,962 f.s.

2nd, it can be shown that for low angles of elevation the trajectory at that point will have bent 2′.

3rd, suppose the rifle be fired at B. Let AB = 71 feet. (*See Fig.* 3.)

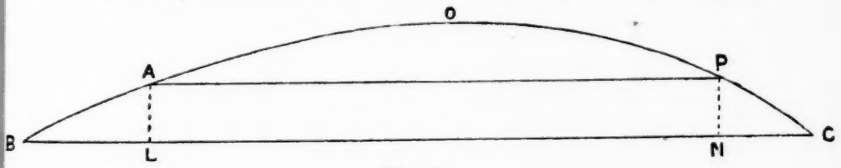


Fig. 3.

Let AP = 500 yards, elevation at B = 32′, elevation at A = 30′.

Then BL = 71 feet, AL = ·62 feet = PN.

and NC = PN cot O = PN × 45·6 = 28 feet.

Hence total increase of range = BL + NC = 33 yards.

If AP is taken as 1,000 yards

total increase = 38 yards,

and if AP = 2,000 yards, total increase = 36 yards.

So there will be no serious error if the total increase is taken generally as 35 yards.

That is, an increase of 2′ in elevation and a change from 1,962 to 2,008 f.s. muzzle velocity, gives an increase of range of about 35 yards for all ordinary ranges.

FOREIGN SECTION.

WATER-TUBE BOILERS.

By NABOR SOLIANI: Translated from the "Rivista Marittima, September, 1894,

By T. J. HADDY, Staff-Eng. R.N.

Description and Classification.

If a tube be bent back on itself so as to form a closed circuit of any form whatever, partly filled with water and exposed to source of heat so that one part of it shall be highly heated and the other only moderately so, or not at all, and if we then add a pump to keep up the water supply and a steam stop-valve at the upper or empty part of the tube, we shall have (in embryo) a water-tube boiler which is, in fact, made up of a combination of such elements. When in action, the water is evaporated in the lower part of the tube which is exposed to the fire, and rises into the upper part, which becomes the steam chamber, whilst in the cooler part of the tube a descending current of water is formed to take the place of the water evaporated.

The action here indicated, and in which the circulation of the water is a natural one, is common to all water-tube boilers. There are, it is true, water-tube boilers differently constituted, in which the circulation is forced by mechanical means, but these are only few in number, and have now been abandoned; forced circulation not being very suitable for the functions of these boilers.

The above description, which only applies to boilers with natural circulation, would therefore appear to be justified, but we may include all types under the following definition:—"Water-tube boilers are those in which the water to be evaporated is contained in the tubes which form the heating surface." Whilst in ordinary boilers the water to be evaporated is contained in a large receptacle, and the water is heated by the products of combustion passing along the sides of this receptacle and through tubes which traverse the body of water in it, in water-tube or tubulous boilers, on the contrary, the water is contained in the heating tubes themselves, which in reality constitute the whole boiler; hence their name—water-tube-boilers. These boilers have been brought into use, both on land and on board ship, since the ordinary boilers, and should therefore fulfil conditions which the latter cannot satisfy.

What are these conditions? On land it is principally with the view of preventing explosions or rendering them less disastrous in their effects, and on board ship, to economise weight, or, more precisely, in ships of war, the necessity of having boilers which can stand regularly without injury, and efficiently utilise the enormous power of combustion

which forced draught enables us to develop, and which marine flame-tube boilers, whether of the ordinary cylindrical or locomotive types, cannot possibly support. Other important advantages, of which I will say more presently, have tended to hasten the adoption of water-tube boilers, as, for example, the facility with which they can be replaced on board ship; but, as I have said, it is essentially the exigencies of great power with little space and weight—not ephemeral, but real, certain, and of practical use—which has forced them into competition with the flame-tube boilers, and which will cause them to triumph eventually.

We have seen that, in its elementary form, a water-tube boiler is constituted of a collection of tubes forming a closed circuit, in one section of which, that exposed to the fire, an ascending current of water in a state of evaporation is formed; and in the other, a descending current of cooler water, which goes to take the place of the first. But it is not necessary that there should be a descending section of tubes corresponding to the ascending section; it is rather, and must be, otherwise, a few descending tubes being sufficient; and even one only, if large enough, may be capable of supplying all the ascending tubes, which must, in general, be numerous and small in diameter in order to give a large heating surface in a small volume and with little weight. Similarly, it is not necessary nor convenient that there should be as many steam chambers as there are tubes, but, on the contrary, there is only one chamber for the steam as a rule, of proper capacity, and in general it is well adapted to the functions it has to fulfil.

This process of organic selection has resulted in water-tube boilers being constructed in general with two receivers, a lower and an upper, connected by a number of tubes of small diameter, which form the ascending section, and with a few tubes of less diameter, forming the descending section. The upper receiver is the steam, and the lower the water chamber. By their nature water-tube boilers are capable of extensive variation in form, and there are now actually in use, or proposed, as many different types as there are possible combinations of the elementary tubes and receivers of which they are composed. Naturally these boilers are not all equally good, and some which are good for some services are not good for others.

To pass them all in review would be a long and tiresome task, so I shall limit myself to observations on typical boilers, around which all the others may be grouped and classified, giving the preference to those which have been employed on board ship, and, unless specially mentioned to the contrary, I shall in the present study speak only of water-tube boilers having a natural circulation.

1st Group.

Boilers with straight, sub-horizontal tubes, that is, slightly inclined to the horizontal, disposed in series in zig-zag. (By series, we mean when the tubes are coupled together one after the other so as to form a continuous tube from the water chamber to the steam chest.)—The Belleville boiler, already described (*R. U. S. I. Journal*, No. 180, February,

1893), may be considered as a typical boiler of this group, in which the water chamber at the bottom front of the boiler and the steam chamber at the top, also in front, are connected, 1st, by a collection of serpentines, each composed of straight tubes placed in zig-zag one after the other, and which forms the heating surface or ascending section of the boiler; 2nd, by a tube of large diameter, which forms the descending section, and also serves as a separator for the collection of foreign substances.

In this boiler it is well to notice, up to the present, the heating tubes, slightly inclined to the horizontal, are somewhat large in diameter (from 7 to 12 centimetres externally). Many of the land boilers may be classified with the Belleville, but the latter is extensively used on board ship in France, especially in warships, and I understand the English Admiralty has decided to adopt them for their two largest cruisers, the "Powerful" and "Terrible," of 14,000 tons and 25,000-i.h.p.

2nd GROUP.

Boilers with separate, straight, sub-horizontal tubes in parallel nests.—Most of the land boilers belong to this group. Whilst in the Belleville class the tubes, divided into groups, are united in series in each group, or disposed one after the other to form a single tube from the water chamber to the steam chest, in the boilers under discussion, as for example in the Babcock and Wilcox, the tubes, still sub-horizontal and divided into so many groups, are all parallel amongst themselves, and connect separately a vertical tube at one part, which forms the descending section, with another vertical tube at the opposite part of the boiler, and which puts the whole of the tubes of each group in communication with the steam chest.

In the Heine boiler a single sheet of water, the whole width of the boiler, forms the descending section, and the tubes, parallel and in a single nest, leave this section and connect it at the other extremity with another vertical sheet of water communicating with the steam chamber, of which we may say it forms an extension. The order in which the tubes are arranged, separately or in series, is very important in its effects, and of this we shall speak further on. The Heine boilers used on land may be classed with the Oriolle, Lágrafel d'Allest, Yarrow sub-horizontal tube, and Seaton boilers, which all have straight, slightly-inclined, and parallel tubes arranged separately between the water chamber and steam chest.

The Towne boiler also belongs to this group. In it the tubes connect the lower sheet of water at one side of the boiler, which acts at this part as a water chamber, with the upper equal and symmetrical sheet of water at the opposite side, and which acts at this part as an appendage of the steam chamber.

3rd GROUP.

Boilers with curved submerged tubes.—In these boilers the water chamber or chambers, if there are two, placed below, generally at the sides of the furnace, are connected to the steam chamber or chambers, placed above, by nests of tubes, of small diameter, more or less curved, forming

the ascending branch, and by one or more larger tubes which constitute the descending branch. The heating tubes are fitted into the lower part of the steam chamber or chambers, and are consequently entirely below the water level of the boiler. The Normand, White (with spiral tubes), and Fleming and Fergusson boilers belong to this type. If in the Belleville boiler the straight tubes and elbow connections to form each element are replaced by a single bent tube, we shall have a boiler of this group; such is the Du Temple boiler, used with so much success on the ships and torpedo boats of the French Navy.

With a single tube, the bend at the elbow being an easy instead of a sudden one, as in the Belleville, the resistance to the movement of the fluid is much less, and the circulation is therefore more active, the elbows themselves helping powerfully to render the circulation more energetic, the tubes at this part having an almost vertical direction. For this reason in the Du Temple it is possible to employ tubes of small diameter (from 20 to 30 millimetres), with great advantage in the lightness of the boiler, and which is not possible in the Belleville.

4th GROUP.

Boilers with curved tubes, partly emergent, or above the water level.—These boilers are similar to those just described, except that the tubes are fitted into the steam chamber partly above and partly below the water level of the boiler. The difference is important from its influence on the circulation and action of the boiler. The Thornycroft, Moser—which is a Thornycroft boiler with two lateral steam chambers instead of one central one—the Cowles, and Ward boilers belong to this group.

5th GROUP.

Boilers with straight, sub-vertical (slightly inclined to the vertical) submerged tubes.—Are like the preceding, formed of one or two water chambers situated below and by one or two steam chambers above, connected to each other by nearly vertical tubes wholly below the level of the water in the boiler. The Yarrow and the Blechynden—which last differs from the Yarrow solely by the tubes being slightly bent to facilitate the operation of removing or replacing them by passing them through small holes in the sides of the steam chamber—each belongs to this group.

6th GROUP.

Boilers with circular-shaped tubes.—In these boilers, which have the form of a vertical cylinder, either circular or elliptical, the heating surface is composed of large spirals of tubes, or segments of spirals, concentric with each other, rising from the water chamber to the steam chest. The water chamber is sometimes annular and forms the exterior base of the boiler; sometimes it is a central vertical tube in the boiler, its upper part serving as a steam chamber; and, finally, in other boilers the exterior annular and the central tube are combined. The segments of tubes are either fixed at one extremity into the water chamber and at the other into the steam chamber, as in the Morin boiler,

or are joined to vertical and horizontal tubes, which put them into more direct communication with the steam chamber, as in the Ward boiler. The segments may be more or less inclined, that is, the spiral forming them may be a more or less rapidly ascending one. The Ward boiler has been applied with much success on the American warship "Monterey." The grate takes the form of the boiler, that is, is either circular or elliptic.

7th Group.

The Field water-tube boiler.—The Field boilers are well known. In them the typical circuit of the water tube is carried out in each element of the boiler, composed as it is of two tubes, one inside the other. The descending current is formed in the inner, and the ascending in the outer tube. In the Field boiler the tubes are generally placed vertically in a cylindrical vertical fire-box. If the tubes are inclined and fixed into the chamber forming the ascending section of a Lágrafel d'Allest boiler, in which the opposite section has been suppressed, we shall have the Dürr boiler, much used for land purposes, but which has also been used successfully on board ships of the German Navy.

If, then, we substitute for the single sheet of water in the Dürr boiler a number of vertical tubes of appropriate forms we shall have the Niclausse boiler, much used in France both on board ship and on shore. Both in the Dürr and Niclausse boilers, a vertical diaphragm, applied at the upper mouths of the internal tubes, keeps the ascending current issuing from the external tubes separate from the descending current entering the internal ones. The boilers are so made that all the tubes can be easily examined and repaired, or renewed. If in a locomotive boiler the cylindrical part containing the heating tubes be suppressed and the furnace be prolonged instead, to form a chamber the whole length of the boiler, and if Field tubes be fitted to the upper part of this chamber in the ordinary manner, we shall have a Kingsley boiler, as used in America, and which appears to me to be very well adapted for secondary services on board ship.

8th Group.

Boilers combining the ordinary and water-tube systems. — These boilers do not really belong to the ordinary water-tube class of boilers, inasmuch as the principle that all the heating surfaces shall be formed of tubes filled with water is departed from in them, but I think it is well to mention them because they are fundamentally composed entirely of tubes, and also because the idea of inserting ordinary heating tubes in the water tubes, as carried out in some of them, is original, and may be fruitful of success; such is the Bartlett boiler. In it the tubes are in an inclined position between two vertical sheets of water, as in the Lágrafel d'Allest, and are traversed by ordinary flame tubes, which connect the exterior walls of these two sheets of water in the manner of stay tubes. The Andersen and Lyall boiler also belongs to this class.

ANALYSIS OF WATER-TUBE BOILERS AND THEIR FUNCTIONS.

Passing thus in review the various types of boilers, as far as regards their general structure, it will be well to examine more particularly into their construction, in order to see how this should conduce to the greatest economy of the boilers, which is to say, how it may satisfy in the best manner possible the requirements of efficiency, durability, facility of repair, etc.

I may commence at once by stating that, in my opinion, all these boilers are good for land service; it is only on board ship, and especially with forced draught, that difficulties make themselves felt. It is then that imperfections become apparent, whether they proceed from insufficiency of circulation or of furnace capacity, or accommodation to expansion and deformation by heat, or whether they are due to complication of parts, bad workmanship, or unsuitable material, etc.

Water circulation.—In water-tube boilers, when they are in action, an energetic natural circulation is established, which takes the form of an ascending current in those tubes which are highly heated and a descending current in those less so or not at all. What is the force which produces this effect? Many think that it lies in the difference in weight of the two columns, the fluid in the ascending branches being the lighter, both from the fact that it is hotter and also that it is composed of a mixture of water and steam. This explanation does not appear to be the correct one, at least in a general sense; in fact, neglecting for a moment the difference in weight due to the difference in temperature, and therefore in the density of the water in the two branches, which although small would constitute a motive force in the sense indicated, it is not easy to understand why the presence of bubbles of steam in a branch can give rise to a motive force in the mass of the water, at least whilst the latter is sufficient in quantity so that the bubbles of steam in a tube can rise freely without disturbing the continuity of the column of water throughout the whole of its height, that is, the statical counter-pressure which this column exerts on that in the other branch.

We may understand, however, that the bubble of steam, by forcing its passage through the mass of the water, tends to draw the liquid after it in its motion, and, therefore, to create a current in the same direction. This is no more the case if the bubbles of vapour are so plentiful as to form with the liquid a kind of foam almost entirely filling the tube. In such a case the continuity of the column of water no more exists, and the proposition that the generating force of the current lies in the difference in the weight of the two ascending and descending branches may be true, or, at least, approximately so. However this may be, it is a fact that the current becomes the more energetic the greater the heat received by the heating tubes; consequently, the greater the activity of combustion. This fact constitutes the great advantage of water-tube boilers with a natural circulation of the water, as in them the circulation increases and diminishes automatically with the requirements, which does not happen in boilers where the circulation is forced, and

in which it is almost impossible to maintain it in proper agreement with the activity of combustion. This explains the want of success with boilers having a forced circulation, and the reason that they have been given up.

From what has been said it is easy to argue that the existence of water tubes not exposed to the action of heat is not strictly necessary to obtain the circulation, which can be established and be energetic enough without them, provided that there is a sufficient number of the heating tubes so far from the fire that the water contained in them is not evaporated by the heat, or not evaporated rapidly. This is exactly what happens, for example in the Oriolle and in the Yarrow and Thornycroft boilers of recent construction, in which the external descending tubes, or down comers, are suppressed.

The diameter, length, and arrangement of the heating tubes have an influence on the circulation, as well as the activity of combustion, the state of the internal surfaces, and the pressure of steam. With the decrease in diameter of the tubes their sectional area diminishes much more rapidly than their external surface, and we soon arrive at a point where the external heat is sufficient to evaporate a large proportion of the contained water and so render it incapable of absorbing sufficient heat from the tubes, which then soon become overheated and damaged. This limit is evidently reached the more quickly the more intense the heat applied, and consequently in boilers intended to be actively forced the diameter of the tubes cannot be reduced below a certain limit. This limit varies according to the form, arrangement, length, quality, and state of the internal surfaces of the tubes. If the tubes are dirty internally, not only is the resistance to the circulation of the water increased, but the power of the heating surfaces to absorb heat is lessened and the tubes are soon injured. If the tubes have many sharp bends, which increase the resistance to the circulation, as for example in the Belleville boilers, the limit is reached sooner, and it is necessary to use larger tubes. Other things being equal, the circulation is more brisk the nearer the tubes are inclined to the vertical, making it more easy for the bubbles of steam to ascend as they are formed. If tubes of equal diameter have different lengths, but have the same inclination and the same collective length, and, therefore, the same total heating surface—admitting also in the two cases that the frictional resistance is simply proportioned to the length—then the total volume of fluid of the same density circulating in a given time is the greater in the shorter tubes, although the velocity of the current in them is less, this inferiority being more than compensated for by the greater number of tubes.

For this reason short tubes are probably more suited to stand intense combustion than long ones. This appears to me to be evident in the case of separate straight tubes, especially if they are only slightly inclined, that is, nearly horizontal, as in the Lágrafel d'Allest and Oriolle boilers, etc. In such a case the density of the mixture of water and steam will be relatively more uniform in the shorter tubes, that is, with equal average densities, the difference in density at the two extremities

of the tubes will be greater in the long tubes, and the water more vaporous than in the short ones; and as the lower rows of tubes are equally exposed to the heat, whether long or short, the danger of damage by heat will be greater in the long. This is not so clear if we compare straight tubes in series with those arranged separately. In the first place it must be observed that whilst in a nest of separate tubes the density of the mixture of water and steam is least in the lowest and most highly heated tubes, with a nest of tubes in series the density is greater in the lowest and gradually decreases as it reaches the highest tubes. For this reason the limit of "vaporosity" of the mixture may be higher with tubes in series without risk of injury to the tubes, but on the other hand, in order that this limit may not become a dangerous one in the upper tubes, it must be very low in the lower ones, whilst with tubes on the separate system it may be raised to its maximum in the lower tubes, compatible with safety, without risk of its becoming excessive in the upper ones.

This being granted, the question which it is, before all, necessary to consider is the intensity of heat which the lower rows of tubes can support in the two cases, the tubes being by hypothesis equal and exposed in a similar manner to equal sources of heat, and we may, therefore, admit that the quantity of heat each receives under equal conditions is the same. The only difference is in the density and velocity of the mixture in the lower tubes, and in order that these tubes may be equally heated in the two cases, it is necessary that the quantity of heat absorbed by the mixture contained in them should be equal, that is, the quantity of steam generated in them must be the same in each case. Therefore, given Δ_d and V_d as the density and velocity of the mixture in the lower separate tubes Δ_s and V_s, the density and velocity in the case of the series tubes, then approximately $(1-\Delta_d)\ V_d = (1-\Delta_s)\ V_s$ (1); that is, in the lower tubes the velocity of the mixture must be inversely proportional to its vaporosity.

Now, if there are two boilers, one with n rows of n parallel tubes and the other with n groups of n tubes, equal and equally inclined, but placed in series, in each we shall have n tubes in the lower rows, but in one case they will be independent of the tubes above them, and in the other they will be connected in series with them. Supposing the resistance to motion in the tubes to be *nil* for the moment, the velocity of the mixture will depend upon its density and upon the difference of level in the final extremities of the tubes in both cases. What will be the average minimum density possible? It seems to me to be reasonable to suppose that the mean minimum density possible will be that which will give the most intense total circulation, and in this case the mean density will be about half that of water, that is, the mixture will be half water and half steam. This will be the density of the mixture in the lower tubes of the boiler with separate tubes, and will also be the density at half the height of the series of tubes in the other. The mean density being equal in the two cases, the velocity of the mixture will depend solely on the difference of level; and as this is n times greater with the tubes in series, the mean

velocity in these tubes will be $\sqrt{n}$ times greater; not, however, in all the tubes, but in those at half the height of the series. In the lower tubes the velocity will be less, (the weight of the mixture passing through each tube in the series being equal,) and will be less in inverse proportion to the density of the liquid contained in them.

Therefore, if V_d is the velocity of the mixture in the lower tubes in the separate system, $V'_s = V_d \sqrt{n}$ will be the velocity in the middle tubes of the series system, and if Δ_s is the density in these tubes by the preceding reasoning—

$$\Delta'_s = \Delta_d \qquad (2)$$

$$\Delta'_s V'_d = \Delta_d V_d \sqrt{n} = \Delta_s V_s \qquad (3)$$

and comparing this relation with the preceding in (1) we shall have

$$V_s = V_d + \Delta_d V_d (\sqrt{n} - 1) \qquad (4)$$

$$\Delta_s = \frac{\Delta_d V_d \sqrt{n}}{V_d + \Delta_d V_d (\sqrt{n} - 1)} \qquad (5)$$

and if the combustion be forced to the point that the resultant $\Delta_d = \frac{1}{2}$, that is, the mixture is half water and half steam in the lower tubes of the separate boiler tubes—

$$V_s = V_d + \tfrac{1}{2} V_d (\sqrt{n} - 1) \qquad (6)$$

$$\Delta_s = \frac{\frac{1}{2} V_d (\sqrt{n}}{V_d + \frac{1}{2} V_d (\sqrt{n} - 1)} \qquad (7)$$

as a practical example, if we compare a Lágrafel d'Allest boiler, with sixteen sets of tubes of sixteen tubes each, with a Belleville boiler having sixteen groups of tubes in series, with sixteen tubes in each group, $n = 16$ $\sqrt{n} = 4$, and the velocity in the lower tubes of the boiler in series is $V_s = \frac{5}{2} V_d$, and the density of the mixture in these tubes is $\Delta_s = \frac{1}{5}$. In the upper tubes the density of the mixture would be about $\frac{1}{5}$, and its velocity would be about 20 times that in the lower tubes of the boiler with the separate tubes. If this were really so the conditions on the whole would appear to be favourable to the boilers with tubes in series, since in the lower tubes most exposed to heat the density of the mixture would be much greater and its velocity double that in the boiler with separate tubes, whilst at half the height of the series, where the heat is not so great, the velocity of the mixture, with equal density to that in the separate tube boiler, would be four times as great, and, finally, in the upper tubes the circulating mixture is still humid, having about 20% of water. But this is no longer the case if the resistance to the motion of the liquid, by reason of friction in the tubes, changes in direction at the bends, &c., is great, as in this case the balance may be in favour of boilers with separate tubes, where the resistance to motion is solely that due to the slight friction at the surface of the tubes.

In the case considered of a Lágrafel d'Allest and a Belleville boiler, whilst in the first the velocity of the water in the lower tubes (the density being $\frac{1}{2}$) would be about 5 feet per second, in the Belleville boiler, supposing, which is probable, that at every bend there is a loss equal to that corresponding to the mean velocity of the mixture, the velocity in the tubes at half the height of the tubular series would be about $7\frac{3}{4}$ feet per second instead of about 13; and also supposing, which would seem

to be plausible, that the density of the mixture in the lower tubes is as at first ·8, the velocity in these tubes would be about 5 feet per second, that is, equal to that existing in the lower tubes of the Lágrafel, instead of being more than double, which we have seen is necessary in order that the extraction of heat from the sides of the tubes may be equal in the two cases. This being so, in order that the lower tubes of the Belleville boiler may be nearly equally heated with those of the Lágrafel (with reference to the heat which they can safely support), their diameter must be greater, about double that of the Lágrafel. This, in fact, is the case, as the external diameter of the Belleville tubes varies from $7\frac{1}{2}$ to 12 centimetres (about 3 inches to $4\frac{3}{4}$ inches), whilst the diameter of the Lágrafel tubes is hardly 5 centimetres (about 2 inches).

The case is different if we consider a Du Temple instead of a Belleville boiler. In the latter, although the heating tubes are bent on themselves into straight tracts, as though composed of so many straight tubes placed in series, the bends are so easy that the loss produced by them is almost *nil*, and either for this reason, or because the tubes are more inclined, of copper, and the bends less numerous, the Du Temple boiler is able to support a very intense combustion with tubes of very small diameter (·8 to 1·2 inches diameter), smaller, in fact, than those used in boilers with separate straight tubes.

Influence of the quality and state of the tubes.—The influence of the quality of the tubes and the condition of their internal surfaces on their capacity for receiving and transmitting heat is obvious. As is well known, a slight stratum of incrustation or of fatty deposit on these surfaces is sufficient to diminish in a remarkable degree the capacity for transmission of heat, and to destroy any superiority which may exist in this direction in the quality of the material of the tubes. For this reason very little dependence can be placed on the quality of the material as affecting the efficiency of the heating surfaces; the choice is, therefore, determined by other criteria, of which we shall speak further on.

Influence of the steam pressure.—The pressure of steam has a beneficial effect on the efficiency of the circulation, and promotes the extraction of heat from the heating surfaces, since an increase of pressure causes a decrease in the volume and increases the weight of steam which can pass through the tubes with a given density of the mixture and velocity of current. The beneficial effect of the pressure in increasing the weight of steam circulating in the tubes in a given time is somewhat lessened by the increased density of the vapour itself, which decreases the propelling force promoting the circulation and increases the resistance to the movement of the vapour in the tubes; but this decrease is relatively unimportant. Mr. Thornycroft has carried out some important experiments on this point, published by him in the "Transactions of the Institution of Civil Engineers" in 1890, and in which it is shown that with an increase of pressure the weight of steam generated by the boiler increases proportionately, the volume of the mixture of steam and water in the tubes remaining constant. This tends to prove that the maximum intensity of combustion, and therefore the maximum power, instead of

being constant for a given boiler, as it is in ordinary boilers, increases in water-tube boilers with the increase of pressure under which the boiler is worked. For the efficiency of water-tube boilers it is, therefore, an advantage to work them at a higher pressure than that required for the engines. This is perfectly practicable if the boiler can support without injury the increased pressure, as it is then easy to reduce this pressure at the engines to what is required, with the advantage that the variations of pressure to which water-tube boilers are specially liable are not so much felt in the engines.

Submerged and emergent tubes.—With regard to the preference to be given to submerged tubes, or to those partly emergent above the level of the water in the boiler, opinions are very much at variance. The advocates of submerged tubes say that they are not so exposed to injury by changes in the water-level when the combustion is forced or slackened during the manœuvring of the engines, which danger is increased in emergent tubes by their being necessarily almost horizontal for a certain part of their upper lengths, and, consequently, favouring deposits there which tend to facilitate their deterioration. The opponents of these tubes reply that by adopting a proper diameter and arrangement of tubes the defect attributed to the emergent system is non-existent, whilst the circulation in them is more energetic and regular. That the circulation is really more energetic does not appear to be well established, nor can we well see the reason why it should be so, but on the other hand we may easily admit that it is more regular. With emergent tubes, when the circulation is established, the vaporous mixture in them always encounters the same resistance to its flow through them, and to its discharge into the steam chamber; but with submerged tubes, on the contrary, opening into the steam chamber below the water level, in addition to the constant resistance in the tubes, the mixture has to overcome that of the superincumbent column of water in the steam chamber, and which may be variable in height and density.

The advocates of emergent tubes add that with them the water-level is maintained more tranquil, as it is not agitated by the irruption of the vaporous mixture ascending from the tubes, whence the steam chamber can be reduced to a small volume without loss of efficiency. Thus, whilst in boilers of the locomotive type the volume of the steam space must be at least sufficient to contain steam enough to supply the engines for ten seconds, in water-tube boilers, with emergent tubes, it may be reduced, according to Mr. Thornycroft, to that sufficient to contain steam for a quarter of a second's supply; that is, to one twenty-fourth the volume required in the first boiler. In submerged-tube boilers it is endeavoured to keep the water-level tranquil by suitable diaphragms placed above the mouths of the tubes. On the whole, we may say that the danger of injury to the emergent tubes will vary greatly according to the arrangements of the tubes, and will be practically non-existent where the emergent part of them cannot be reached by the products of combustion until they have been well cooled by the submerged portions of the same tubes.

Straight and curved tubes, facility of examination, repair, and renewal.—The straight tubes generally lend themselves better to the operations of dismounting, renewal, examination, and cleaning internally and externally, besides which they can be connected together, for instance, as in the serial zig-zag groups of the Belleville boiler, so that they are free to expand under the influence of heat; however, as in such a case the tubes must be arranged slightly inclined to the horizontal, and joined together in opposition, almost without any corresponding curve, they must necessarily have a somewhat large diameter. When the tubes are of small diameter, which is the case in the larger number of water-tube boilers, they must be arranged separately, that, is whether they are curved or straight, they must connect the steam and water chambers in one single length. In this latter arrangement curved tubes are certainly better adapted to stand the deformations due to changes of temperature than straight ones; this, however, is a question of degree, and in the opinion of Mr. Yarrow, who gives the preference to straight tubes, the differences in the expansions are so small that they may be neglected. The question is on the whole a very conditional one; the just appreciation of the various points rests on facts not yet well known, and on which experience has yet to be obtained, as well as on the special circumstances of the case with which we have to deal.

For example, where the tubes decay very slowly, the facility of renewal becomes less important, and it is sufficient if this renewal can be effected without much trouble; so much the more so when we consider that, even with the best arrangements for the easy renewal of straight tubes, the operation cannot be carried out without emptying the boiler, that is, without placing it for some time out of action. Besides this, the curved form is not an absolute impediment to the facility of changing the tubes, for there are boilers so fitted which, in this respect, differ very little from those with straight tubes. It would be a very important point if an injury to a tube could be temporarily repaired without putting the boiler out of action, but this advantage, for which ordinary boilers are justly valued, it has not yet been possible to realize in any water-tube boiler, whether with straight or curved tubes. Apart from this, and comparing water-tube boilers amongst themselves, simply from the point of view of accessibility and facility for examination, cleaning and repairing the tubes, we may say that the conditions are generally more favourable in boilers with straight tubes.

We must place the Belleville boiler in the front rank in this respect, which has interchangeable straight tubes, and in which any one can be removed and replaced, without interfering with the others, in a few hours by a couple of intelligent stokers, and with the ordinary means available on board ship. Next to the Belleville, we must rank those boilers with sub-horizontal Field tubes, such as the Dürr and Niclausse, in which the examination and the renewal of a tube can be effected by the removal of a simple screwed plug or cover on the front of the boiler without the necessity of getting inside it; the operation of dismounting and renewing a tube is not much more laborious than in the Belleville, as the tubes are

not expanded into the tube plates or headers which support them. Following these, in my opinion, come the straight separate tube boilers of the Oriolle, Lágrafel d'Allest, Yarrow, and Seaton type, etc., in which the tubes are interchangeable, and examination and renewal of them is carried out from outside the boiler by removing a plug or cover from the front or back of the boiler, but in these the operation is more difficult than in the type just mentioned, as the tubes are expanded into the tube plates and headers, both fixed, which support them. After these come the boilers with separate tubes, straight or curved, and sub-vertical (as are the Yarrow, Blechynden, Fleming and Fergusson), in which the straight or curved tubes can be dismounted or replaced from inside the steam chamber independently of each other. Lastly come the boilers with curved tubes, Thornycroft, White, Normand, Du Temple, etc., in which the tubes are of different curves, and to remove one of them necessitates the removal of several others. The tubes are cleaned externally from the deposit of dirt and ashes by means of a jet of water or, preferably, of steam. This is naturally most difficult in boilers with straight or curved tubes nearly vertical, as the dirt and cinders collect at the lower ends on the water chambers, where it is difficult to dislodge them, whilst with tubes nearly horizontal the cinders fall of themselves into the furnaces.

Mr. Yarrow, in order to facilitate the cleaning of the tubes externally in his boilers with nearly vertical tubes, has made the outside casings movable, giving up the advantage of reduced radiation by having the casing fixed, and composed of a single row of water tubes, as in the Blechynden, Thornycroft, Moser, etc., boilers. For cleanliness also due regard must be had to the spacing of the tubes, the interval between them being different at various parts of the boiler, to allow for the passage of the products of combustion; to this end it may be convenient to allow a large interval in some places, and to regulate the course of the flame and gases by suitable diaphragms.

Corrosion.—The corrosion, which manifests itself to a great extent in the form of pitting in the internal surfaces of the tubes, is one of the points which requires much attention in water-tube boilers, especially in the lighter description which have thin tubes of very small diameter. In those the corrosion, slight though it is, may be sufficient to perforate the tubes and necessitate laying up the boiler for repairs. The danger is increased by imperfections such as groovings, blisters, welding defects, etc., which generally occur in tubes, whether seamless, drawn, or welded, and which are so slight as not to be perceptible on examination before the tubes have been in use. Corrosion also takes place on the external surfaces of the tubes from the corrosive action of the wet and saline matter contained in the dirt and cinders which are deposited on them; it is less dangerous than the internal corrosion, which also takes place when the boiler is not in use, and in spite of all the care which is taken to prevent it. This is a very serious defect for ships of war which have long periods of inaction, for it may, and does happen in such cases that boilers considered in good condition, when left inactive for some time, are found to leak the first time they are used. This defect, however,

exists not only in water-tube boilers, but in all boilers, more or less, which have iron or steel tubes.

Experiments carried out in our navy appear to show that of the two methods of preservation, the "dry" or the "wet," the latter is the more efficient. It is necessary to take care, however, that in water-tube boilers with emergent tubes the upper curve of the tubes is completely filled with water. The defect of corrosion would be certainly overcome by employing tubes of brass or copper instead of iron or steel, but brass does not appear to be a suitable material, from the rapid reduction in its tenacity when heated beyond a certain limit, and which may easily be reached when the tubes are emergent, and even with submerged tubes, if they become foul. This is the decided opinion of Mr. Thornycroft, who has completely given up the use of this metal for his boilers; he is more in favour of copper tubes, especially in boilers with submerged tubes, but in his own, which have emergent tubes, he prefers steel. Mr. Yarrow and M. Du Temple use copper tubes in their submerged tube boilers, and, it appears, with good results; it remains to be seen, however, whether the galvanic action which takes place between these tubes and the other parts of the boiler will not constitute an equally serious defect. Many other authorities on this question vote for the exclusion of both copper and brass from these boilers. Mr J. T. Milton, of Lloyd's, advises the use of steel seamless tubes; Mr. Ward, on the other hand, the well-known manufacturer of the circular water-tube boilers, whilst he believes that copper is preferable to brass, proposes tubes of very soft iron, made at a wood-charcoal furnace. Mr. Yarrow suggests galvanizing the iron or steel tubes internally to enable them to resist corrosion, and thinks that seamless drawn tubes are to be preferred to welded, since, in the operation of welding, fragments of scale may be easily introduced and favour corrosion. The employment of sheets of zinc, which has proved so successful in ordinary boilers, has also been recommended for the preservation of water-tube boilers. On the whole, as regards corrosion, the material best adapted for the tubes of water-tube boilers is another doubtful point on which we must wait for the light of experience to guide us.

Connections of the tubes with each other and with the other parts of the boiler.—These connections must be such as to be steam tight and to remain so when the boiler is forced to its greatest activity. The junction may be carried out in various ways—by screwing the tubes into their sockets, by screwed coupling pieces, etc., or by simply expanding and rolling the tubes into the holes which receive them. The first plan is only applicable to straight tubes, which have to be fixed at one end only, and even in this case it is generally preferred to use the last method, which is easier and equally efficient. The coupling pieces are used only in those boilers or parts of the boilers in which a simple expanded junction is not possible. The Ward boilers have all the unions of the tubes made with screwed coupling pieces, even in those parts exposed to the fire, and with good results; but, notwithstanding this, the general opinion is that they form a more delicate connection than the simple

expanded one, and should be avoided when possible. It is, perhaps, well to note that with the expanded joint the internal pressure tends to keep it tight, which is not always the case with the screwed one. But, however they may be made, the joint is always a weak point with respect to the rest of the tube, and the generally accepted opinion appears to be the correct one, that the junctions should in no case be exposed to intense heat.

Efficiency of the heating surfaces.—For this efficiency two conditions are necessary: 1st, that the tubes should be arranged normal, and preferably in lozenge fashion, with the course of the gases of combustion, so that these are constantly diverted in their passage between the tubes and prevented from escaping directly to the funnel; 2nd, that the gases of combustion are compelled to pass over the whole length of the tubes by means of a suitable form being given to them, or by baffle plates introduced for the purpose, so that the whole length of the tubes is available as heating surface. We have already said what precautions are required that it may not be too difficult to keep the tubes clean externally, and consistently with this the smaller the diameter of the tubes the less should be the space left between them up to the limit necessary to allow an unrestricted passage for the products of combustion. The heating surface obtained by water tubes does not appear to be so efficient as that of the ordinary flame tubes, perhaps because it is difficult to have all the surface in action, but there is much difference in the different boilers with respect to this point.

Capacity of the furnace.—The space above the grate, between it and the tubes, must be large enough to allow complete combustion of the gases to take place before they come into contact with the tubes. This is essential to the efficiency of combustion and for the preservation of the tubes, as was well shown by the late Dr. Siemens in his important article on "Combustion with free development of flame." Where this condition is not satisfied, combustion becomes incomplete, with consequent loss of economy and formation of dense smoke, causing fouling and speedy deterioration of the tubes. It may also happen that the unconsumed gases become again ignited beyond the nest of tubes, causing injury to the casing and funnel of the boiler, with all the bad consequences resulting from it; besides which the pendant of thick smoke formed at the top of the funnel is in itself, for warships, a serious defect. The importance of space in the furnaces, although admitted generally by all those who have spoken or written on these boilers, is not in my opinion given due attention to in practice by manufacturers, who sometimes sacrifice it in favour of other requirements, or at least do not give to it the importance which it has in reality.

Arrangement of the tubes with respect to the grate, and space occupied by the boiler.—In many water-tube boilers, especially in those of the Thornycroft and Yarrow sub-vertical separate-tube types, the heating tubes are at the sides of the boiler, and take up much of the transverse space, which cannot, therefore, be utilized for the grate area. This does not of itself constitute a defect, but might be rather the opposite if the

available space on board were ample for the boilers required. Such would be the case, for example, on board a large ship with the boilers arranged in two rows parallel with the longitudinal axis of the ship, and facing each other, but in the case of a small, long, and narrow vessel, such as a torpedo boat—destroyer or scout, etc.—where the boilers must necessarily be placed with their fronts in a transverse direction, the width which is subtracted from the grate by the nests of tubes may constitute a defect. Mr. Thornycroft has recognized this point, and has made his new water-tube boilers with a single, large cylindrical water chamber in the centre for the nests of tubes, and with two water pipes at the sides, which receive the ends of the single row of tubes forming the outer casing; but, with all this, the reduction in the width of the grate is considerable. It is, indeed, true that the importance of ample grate area is of less importance in water-tube than in ordinary boilers, as the combustion can be forced to a greater extent in the former; still, it must be allowed that a large grate area is always useful, whether it be to obtain large powers under natural draught, or to obtain a roomy furnace in proportion to the total quantity of fuel to be burnt in a given time.

In almost all these boilers the nests of tubes are above the grate, so that the boilers are generally short and very high, which is in most cases an advantage, as they occupy little floor space, and the space available for height is generally ample, being limited in torpedo boats solely by conditions of stability and target area. There are some protected cruisers, such as our ships of the "Tripoli" and "Partenope" class, in which the available height is limited to some extent by the protective deck, and for those, water-tube boilers with the whole or part of the nest of tubes behind the grate would be more suitable; for example, those of Cowles and White.

Radiation.—This must be great in water-tube boilers where their exterior casings are composed of refractory material exposed to intense heat, since it is not possible, on account of their weight, to make them thick enough to keep the radiation within moderate limits. Many sub-vertical water-tube boilers have this defect, in which the front and back are of refractory material applied to a metallic skin. In many of those with sub-horizontal tubes the refractory material, besides being fitted below around the furnace, is also applied above it at the sides of the tubes; but even in these the radiation is considerable. Refractory material is certainly useful in the furnace, where it serves the double purpose of protecting the lower parts of the boiler from the destructive action of fire, and of preserving the heated atmosphere in the furnace in which combustion takes place; but it should only form the internal casing of the furnace, the exterior casing being formed of water tubes covered externally with non-conducting material; all the other parts of the boiler casing subject to much heat should be similarly constructed. At the extremities of the nests of heating tubes, where the products of combustion are much cooled, a simple casing of incombustible non-conducting material, such as asbestos, silicate cotton, etc., is sufficient.

The arrangement here indicated is adopted in the Yarrow, Lágrafel d'Allest, and some other boilers.

Maximum power of water-tube boilers.—The maximum power which it is possible to obtain from a single marine water-tube boiler is, it seems to me, only limited by the space in which the boiler has to be placed and worked. We have already advanced from the few hundred horse power of the first water-tube boilers to those of 1,500-h.p. each, in the "Daring," by Messrs. Thornycroft; and Mr. Ward, in his article already cited, after observing that the boilers of the "Monterey" on his system developed 1,100-h.p. each, does not hesitate to say that there is no difficulty in making and working boilers of much higher powers; such is also the opinion of Messrs. Fleming and Fergusson, who have proposed water-tube boilers of 2,000-h.p. or more. It would appear to be reasonable to infer as much as this, as, from the organic structure of water-tube boilers, the same difficulties do not exist to increasing their dimensions beyond certain limits, as are met with in ordinary boilers.

The question of the power of individual boilers is not without importance, since it governs the number of boilers necessary, the space they occupy on board, the number and complexity of the pipes and all the accessories, the total weight of the evaporating apparatus, and the difficulties of management. The larger the boilers and the less their number the more easy is the management of them, and, other conditions being equal, the greater is the economy of weight and space; on the other hand, the effects of an injury to any one of them are much more serious. Other conditions being the same, there should be a larger number of water-tube boilers than there would be of the ordinary type, for in the first case a single leaky tube may be sufficient to put the boiler out of action for many hours, whilst in the latter the same defect could be remedied in a few minutes. For this reason there should be at least two water-tube boilers, even in cases where one ordinary boiler would be sufficient. A number of boilers in a warship tends to limit the ill-effects of an injury to one of them, both as to waste of material and loss of power; but, provided that the number is sufficient to fairly meet the exigencies of the service in this respect, any increase is in my opinion a mistake, as, beyond the inconveniences already mentioned, it would increase the probabilities of the accidents which it is sought to avoid. In the mercantile marine, where the service is more regular and the risks of injury less, the number of boilers is less important, and it would be more convenient to use fewer boilers of larger power.

In the following table are collected the principal data in the large water-tube boilers which Messrs. Fleming and Fergusson propose to construct for the mercantile marine :—

Description of boiler.	Grate area.	Heating surface.	Total weight with water, etc., without funnel.	Weight per metre square of heating surface.
	Sq. metres	Sq. metres	Kilos.	Kilos.
Simple marine - 1 furnace -	2·790	106·95	21·330	18·57
,, ,, - 2 furnaces -	4·464	106·95	23·370	20·34
,, ,, - 3 ,, -	5·580	144·15	31·500	20·34
Double-front marine, 4 ,, -	8·181	204·60	38·610	17·66
,, ,, ,, 6 ,, -	10·230	316·20	55·880	16·308
,, ,, ,, 6 ,, -	12·834	446·40	76·200	15·855

Power capacity of water-tube boilers.—We call the power capacity of a boiler the quantity of steam which it is capable of producing at full power per unit of space occupied, and per unit of weight, including the weight of water contained in it. This evaluation appears to me to be an important one for ships of war, since in most cases it is desired to have in such ships boilers capable of giving the maximum possible power with the minimum of space and weight. With the above definition let E equal this capacity, c the weight of combustible burnt per unit of heating surface, v the weight of steam produced by a unit of weight of fuel, s the heating surface per unit of volume of boiler, and p the weight of this unit of volume—

$$E = \frac{c, v, s}{p}$$

In order that this formula may have a practical value and serve as a term of comparison for different boilers, the co-efficients of which it is composed must be determined in accordance with rational principles, and be of constant and easy application in practice.

The following rules appear to me to be desirable:—

1st—That the fuel be of the best quality as used for steam trials, and that in the value c account should be taken only of the fuel actually consumed on the grate.

2nd—That the quantity of steam produced should be measured from a definite initial water temperature; for example, 100° C.

3rd—That the space occupied by the boiler should be measured by the parallelopiped which would contain it, inclusive of the smokebox.

4th—That the weight of the boiler should include the weight of its immediate accessories or fittings, and the weight of the water at the working level.

Mr. Ward, in his paper, gives a formula similar to the foregoing, which, in his opinion, expresses the efficiency of the boiler E^1, which is expressed by $E^1 = \frac{c, v, s}{p_1}$ where c, v, and s are the same as before, but p_1, instead of the weight of a unit of volume of the boiler, represents the weight of a unit of heating surface. This formula does not appear to me

to be appropriate or reasonable, for it does not express the efficiency of the boiler with respect to the consumption of fuel, because the same product of c, v can be obtained by burning a little fuel properly to produce much steam, or by burning a good deal of fuel badly to produce a little steam; efficiency rather including the idea of output is expressed by Mr. Ward's formula, that is, the fitness or capacity of the boiler for producing steam, and it is perhaps in this sense that he interprets the relative efficiency.

But even in this sense it appears to me the formula is defective, as it attributes undue influence to the heating surface s; if, instead of p_1 in the formula we put its value $\frac{s}{p}$ in the preceding one, it becomes $E^1 = \frac{c, v, s^2}{p}$ where we see that the heating surface will influence the capacity of the boiler in exact agreement with its geometrical extension. This agreement would be acceptable if the hourly consumption of fuel in the boiler and its output in steam were independent of the extension of the heating surface, but it is precisely to the contrary. By increasing s the possible consumption of fuel per hour increases, or its output increases, that is, the value c, v is augmented; so that the beneficial effect exercised on the *efficiency* of the boiler by the increased heating surface is manifest in the product c, v; whence the term s cannot enter into the formula otherwise than in its relation with c, inasmuch as the product c, s gives the measure of the quantity of fuel consumed. For this reason, I believe it is better to hold to the first formula, $E = \frac{c, v, s}{p}$

It is, however, necessary to observe in interpreting this formula that the power capacity E, although referred to the heating surface contained in a unit of volume of the boiler and the weight of boiler existing in this unit of volume, is in substance the power capacity per unit of weight. In order to have a complete criterion of the power capacity with respect to the volume and weight, the expression itself should be considered in its relation to the value of the product c, v, s, which forms the numerator and expresses the power capacity per unit of volume. The first expression is used in the following table to express the power capacity of boilers of different types of which the full power results are known, and the second to express the power capacity of the boilers per unit of volume occupied by them.

Examining the figures in the table, we note generally that water-tube boilers have a power capacity per unit of weight and space superior to that of ordinary boilers. The Belleville boiler is an exception, and is the only one of the water-tube boilers noted in the table which has a power capacity inferior to that of the ordinary boiler. The power capacity per unit of space occupied is less favourable to the water-tube boilers, and on this point they stand about on a level with the ordinary flame-tube type. In the case of the "Hornet" and "Havock," the first with eight "water-tube," and the second with two "locomotive" boilers, the total useful volume of the two boiler chambers occupied per unit of i.h.p. developed is about two per cent. more for the water-tube boilers.

Management of water-tube boilers.—The management of the furnaces requires less care than with ordinary boilers, as they are not so liable to injury from sudden variations in the activity of combustion or from currents of cold air. The management of the feed, on the contrary, requires much more care and attention in water-tube boilers, especially if many are in action together; this is another point in favour of reducing the number of boilers. Many expedients have been tried in order to ensure regularity of feed with several boilers working together, as, for example, automatic regulators, pressure accumulators for the feed water, and special feed pumps for each boiler, so as to make the feed for each boiler as far as possible independent of the others. This delicacy of water-tube boilers in the matter of feed is, perhaps, due to the great variations in the steam pressure and water level arising from the small quantity of water contained in them, but it is also probable that this judgment against them is to some extent magnified by want of experience, and in time, whilst more simple means may be found to ensure regularity of feed, a more accurate estimation of the difficulty which now appears to be a characteristic of water-tube boilers may be arrived at.

Conclusion.—Water-tube boilers are rationally constructed, since, in order to form the heating surfaces, it is necessary to use tubes, and the advantage of making these tubes serve at the same time as recipients of the water is evident. The exterior recipient, which, in the ordinary boiler, encloses the heating tubes, is an abnormal arrangement which has no rational basis, and its absence in the water-tube boiler forms its main feature of lightness as compared with the former, to which also the smaller weight of water which it contains, with equal heating surface, largely contributes. Finally, the power capacity of water-tube boilers per unit of weight is increased by the greater intensity of heat which they can support as compared with flame-tube boilers, in virtue of this difference in their construction. Composed, as they are, entirely of tubes, it is easy to arrange these so that they can freely dilate under the action of fire, and that their extremities, where they are attached to the other parts of the boiler, are not exposed to intense heat, but only the central parts, which can support it without injury when the water circulation is efficient. The latter condition is well provided for, as the circulation is not only natural, but naturally becomes more energetic the more intense the action of the fire. From this fact arises the facility with which water-tube boilers can pass rapidly, and without risk of injury, from the highest to the lowest degree of activity, and *vice versâ*—another important advantage, which, together with lightness, renders them admirably adapted for ships of war.

There are other advantages, however, beyond these. Water-tube boilers can be easily taken to pieces and put together on board without opening up the decks and almost without withdrawing the ship from active service, an operation which, with ordinary boilers, would necessitate laying up the ship for some considerable time. The expenses of construction and maintenance are less, as in water-tube boilers there are only the water tubes to fit and repair, which it is reasonable to admit will cost no more and last as long as the ordinary flame tubes. No danger of

disastrous explosions. There may certainly be such a leak in a water-tube boiler, caused by the corrosion of a tube, as to necessitate drawing the fires, but this will probably be all; the consequences are very different, however, in the ordinary boiler if the leakage occurs in the furnace or combustion chamber. In one point the ordinary boilers have the advantage, this is in the ease with which a leaky tube may be plugged without laying up the boiler, but this superiority will be of less importance if the danger of corrosion in water tubes can be overcome, either by galvanizing them or by the use of non-corroding material. As already hinted, the difficulties with respect to the feed in water-tube boilers may also be expected to decrease with increased experience and the introduction of larger boilers.

The future of these boilers appears to be now assured. What types will be most preferred it is as yet difficult to foresee, but it must at least be left to the process of natural selection. Belleville boilers have certainly given good results and are largely used, both on board merchant ships and ships of war, thanks to the perfection to which they have been brought. They have many advantages besides which make them acceptable on board ship, but they cannot be called perfect nor superior to other types of water-tube boilers now in use, which certainly excel them in power capacity and in other respects. We can, therefore, say that the Belleville boilers must give place to those of other types in all cases where a large power capacity is a primary condition, and for which they are not suitable. Whilst it is thus probable that Belleville boilers will find much employment in ships of medium and large displacements, it is just as probable that the lighter water-tube boilers, such as the Thornycroft, Yarrow, Normand, Blechynden, White, Lágrafel d'Allest, Du Temple, Ward, Cowles, etc., will hold the field for smaller vessels, such as torpedo boats, destroyers, scouts, etc.

NOTE.—Of the boilers referred to in this article the plates illustrating the Belleville, Lágrafel d'Allest, Yarrow, sub-vertical, and ordinary Thornycroft boilers in the original have been already given in the *R. U.S.I. Journal*, No. 179, for January, 1893, but, as it may be more convenient for readers, it has been thought advisable to reproduce them again. A fuller view of the Belleville, and an illustration of the Ward boiler, taken from *Engineering*, have been added, the latter being, as remarked by the author in a note on the subject, a typical boiler of Group 6.

THE TRANSLATOR.

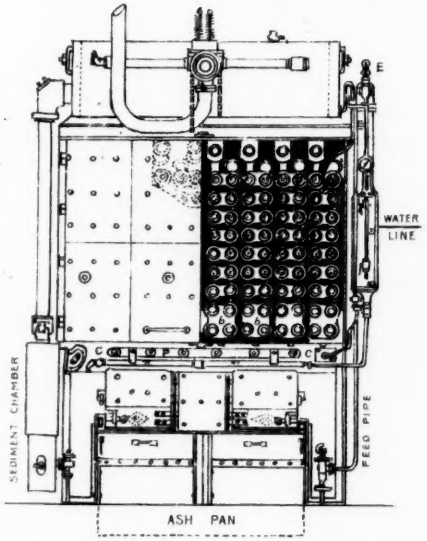
TABLE OF COMPARISON OF DIFFERENT TYPES OF BOILERS.

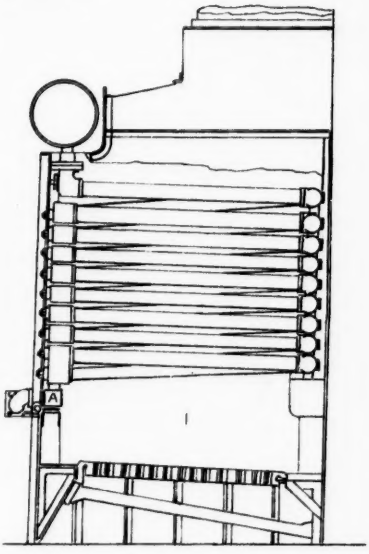
Type of Boiler	Relation of Heating Surface to Grate area	Fuel Burnt: per sq. metre of Grate per hour	Fuel Burnt: per sq. metre of Heating Surface per hour (c)	Forced Draught in centimetres of Water	Steam produced from Water at 100° C: per Kilo of Fuel burnt. (r)	Steam produced from Water at 100° C: per sq. metre of Heating Surface per hour	Steam produced from Water at 100° C: per cub. metre of volume of Boiler per hour	Humidity of Steam per cent. of Steam produced	Heating Surface per cub. metre of space occupied by Boiler (s)	Weight of Boiler with Water per cub metre of space occupied (p)	Power Capacity of Boiler: per unit of weight and volume c, r, s / p	Power Capacity of Boiler: per unit of volume c, r, s	Power developed: per ton of Boiler with Water	Power developed: per cub. metre of volume occupied	Power developed: per sq metre of Heating Surface	Remarks
		Kilos.	Kilos.	c m	Kilos.	Kilos.	Kilos.		Sq. metre	Kilos			H.P.	H P.	H.P.	
Marine Ordinary Double ended	28	—	—	5	—	—	—	—	3·66	880	·266	234	33·3	29·3	8	Of the "Piemonte" (Italian)
Marine Ordinary Single ended	27·6	—	—	1·3	—	—	—	—	3·02	790	·173	137	21·5	17·5	5·67	"Sardegna" (Italian)
Locomotive (Shichau) ..	41	250	6·1	4	—	—	—	—	5·83	750	·394	295·3	48·8	36·6	6·33	"Urania" (Italian)
Do. (Orlando)	48	—	—	4·4	—	—	—	—	6·5	755	·391	295·4	48·8	36·8	5·68	"Aretusa" (Italian)
Do. (Yarrow)	—	—	—	7·5	—	—	—	—	5·47	588	·578	340	72	42·35	7·77	"Havock" (British)
Belleville	29·4	—	—	h.pres.	—	—	—	—	3·70	730	·170	124·3	21·3	15·54	4·20	"Milan" (French)
Lágrafel d'Allest	30	139	4·63	,,	11·19	55·50	440	—	3·33	—	—	172·5	—	20·80	6·25	
Ward	46·6	255	5·47	5·1	8·44	46·28	512	11·6	6·48	385	·776	299·1	77·6	38·05	4·64	
Cowles	43·1	168	3·90	5·1	8·42	34	403	—	6	360	·547	207·0	62·3	22·44	3·74	Water Tube Boilers.
Thornycroft ..	64·5	302	4·68	10·2	6·91	32·63	469	6·68	14·56	600	·784	470·4	87·3	52 42	3·60	"Cushing"
Thornycroft ..	42·3	—	—	—	—	—	—	—	4	240	·81	194·6	100	24·2	6·08	"Daring"
Yarrow	50	—	—	3·8	—	—	—	—	7·44	400	·772	308·8	96	38·5	5·18	"Hornet"

Note.—For those boilers for which the h.p. is given, but the results of evaporation are wanting, the value of the product c, r, s is calculated on the assumption that each i.h.p. developed in the cylinders corresponds to the production of 8 kilos of steam per hour from a temperature of water of 100° C.

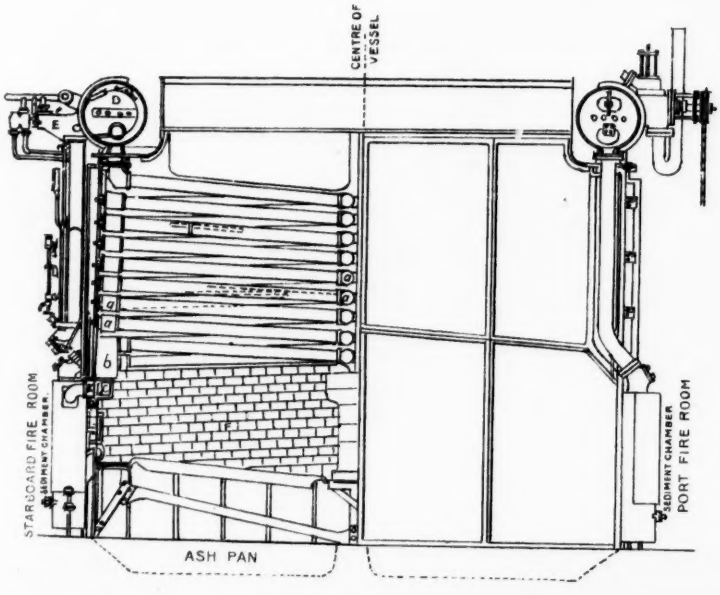
1st Group.

BELLEVILLE BOILER.





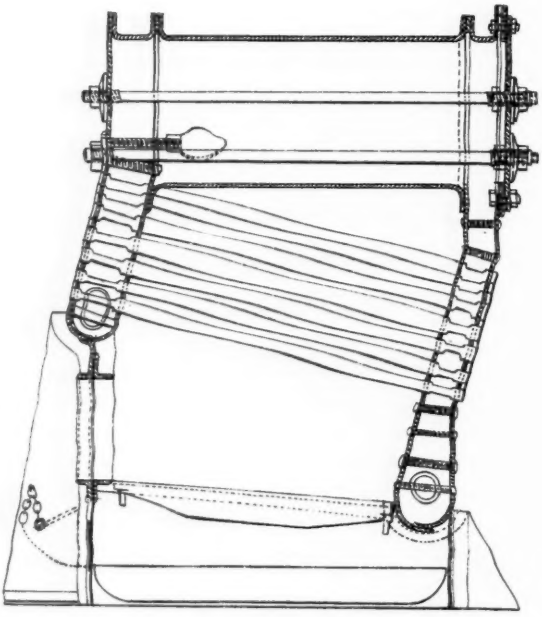
P BLAST PIPE, AIR AT ABOUT 20 lbs. Sq. In. MAX:

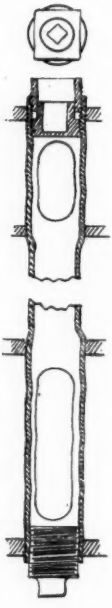


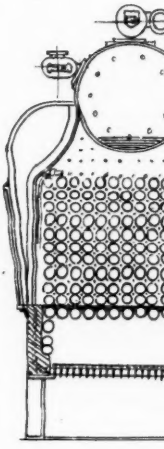
J. J. Kelliher & Co. Litho London

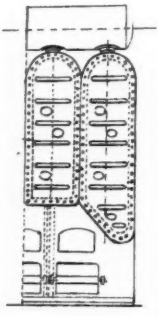
2nd Group.

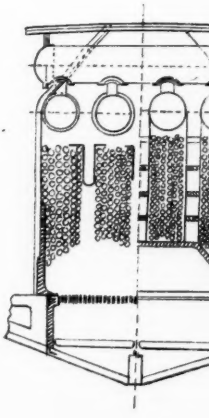
YARROW BOILER.







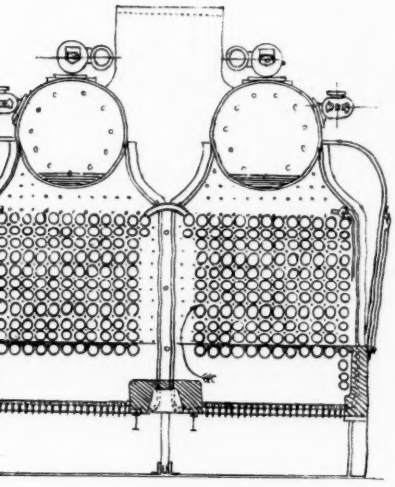


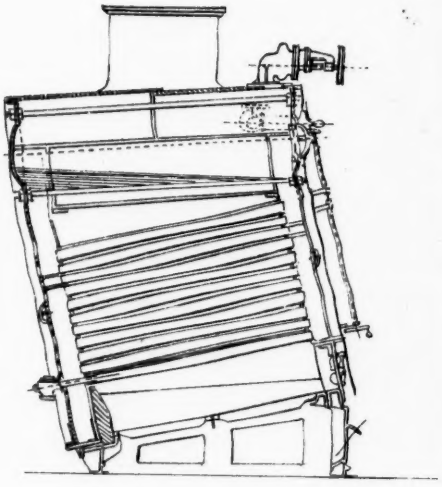


J. J. KELLNER & Co LITHO. LONDON

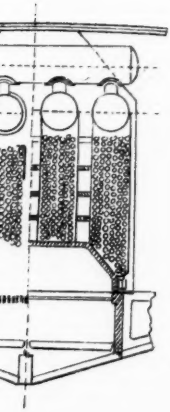
Group.

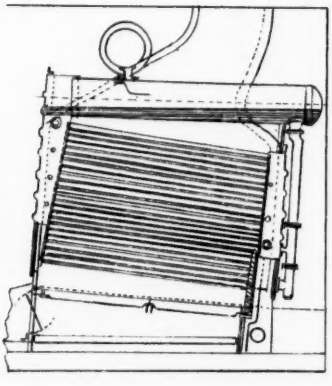
LAGRAFEL D'ALLEST BOILER.





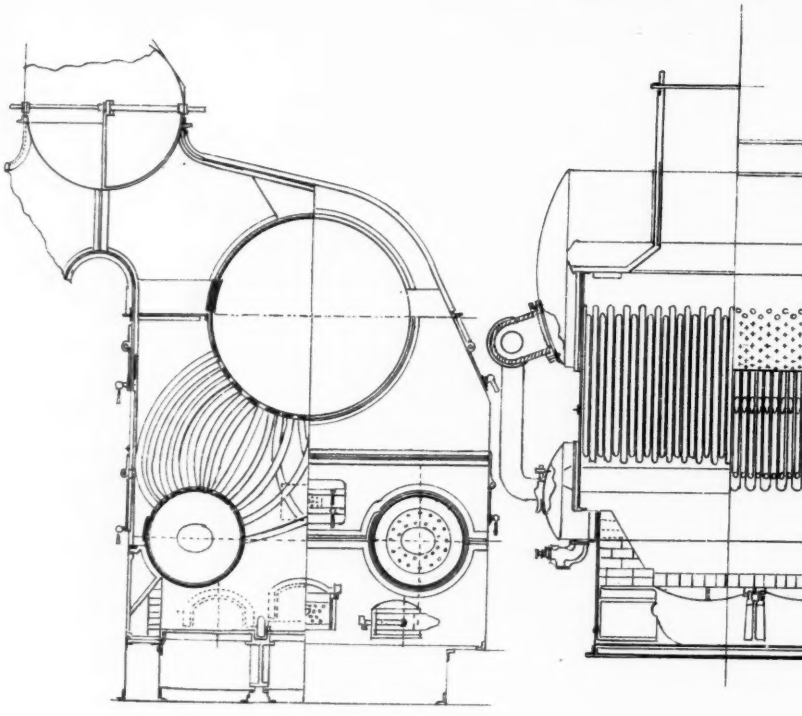
SEATON BOILER.



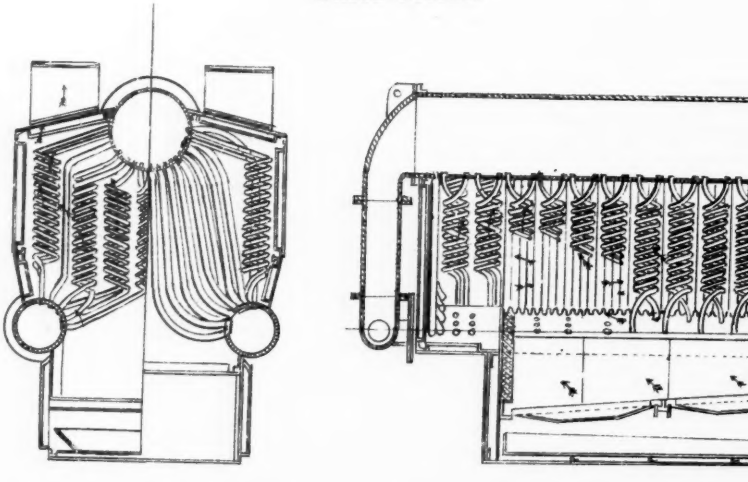


3rd Group.

FLEMING and FERGUSSON B



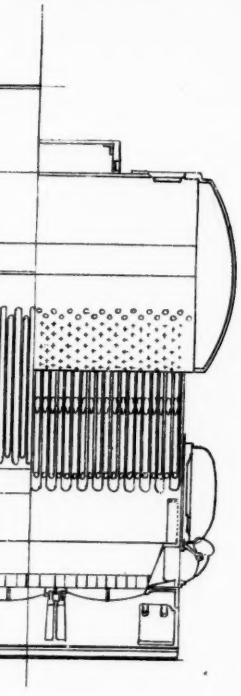
WHITE BOILER.



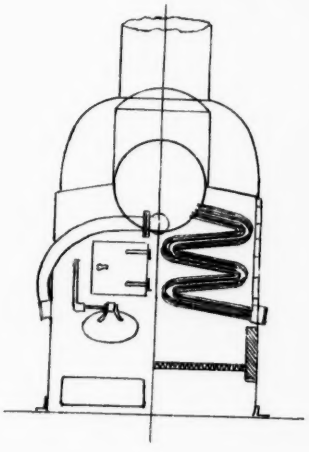
J. & J. KELLNER & Co. LITHO. LONDON

oup.

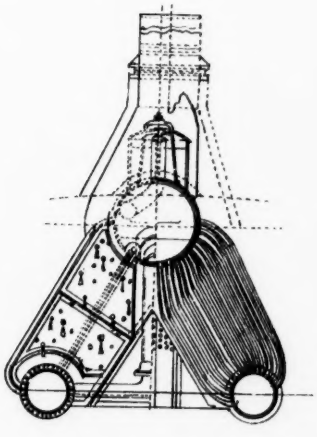
GUSSON BOILER.

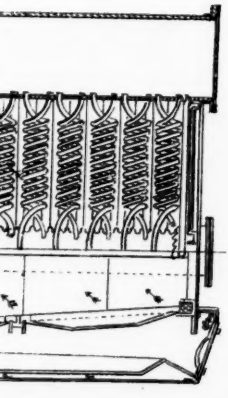


DU TEMPLE BOILER.

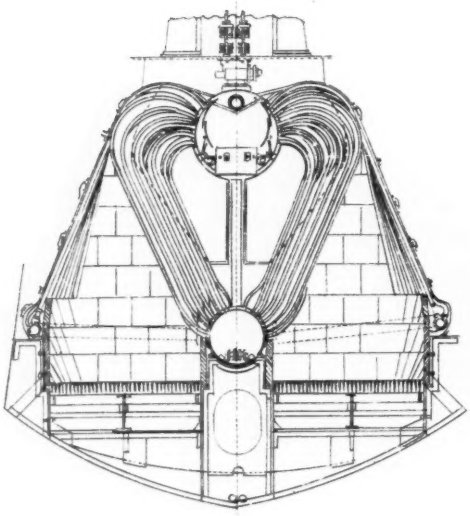


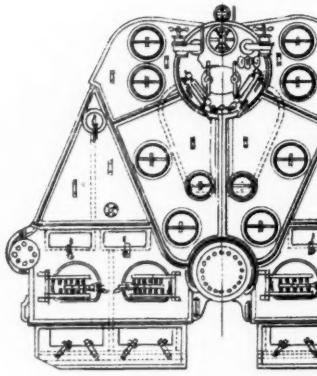
NORMAND BOILER.

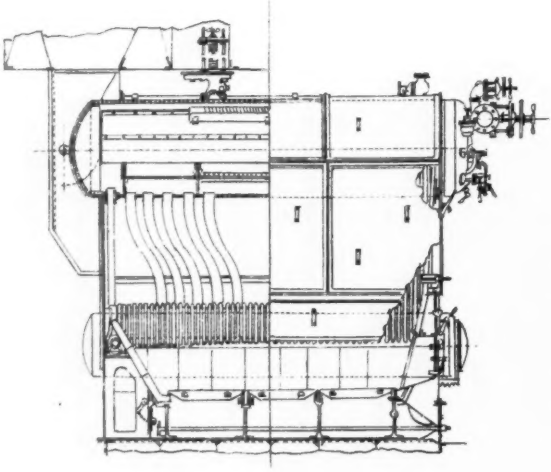


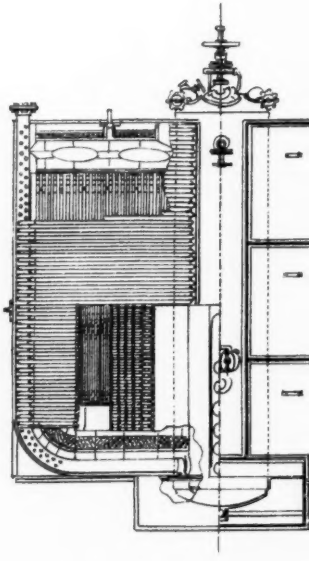


THORNYCROFT BOILER (Modified) "Daring" Type.









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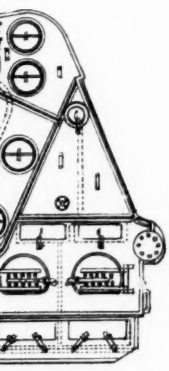
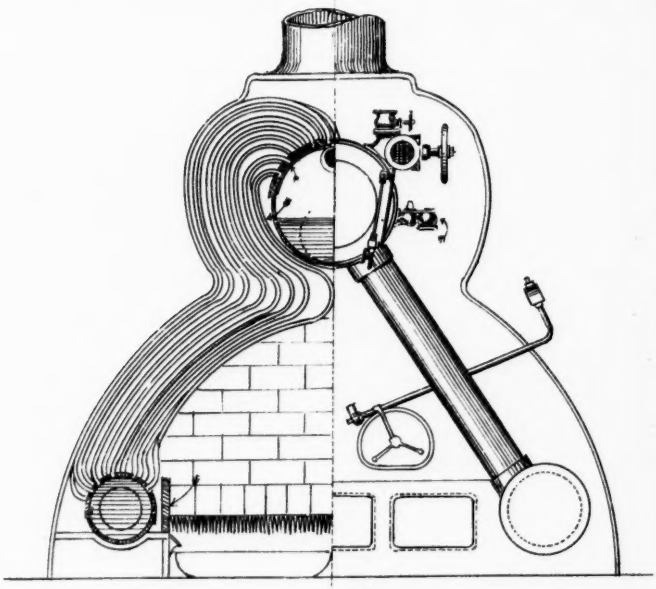
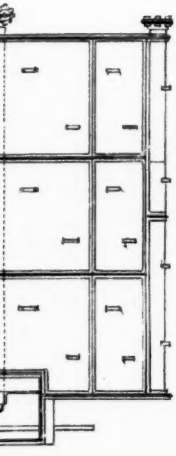
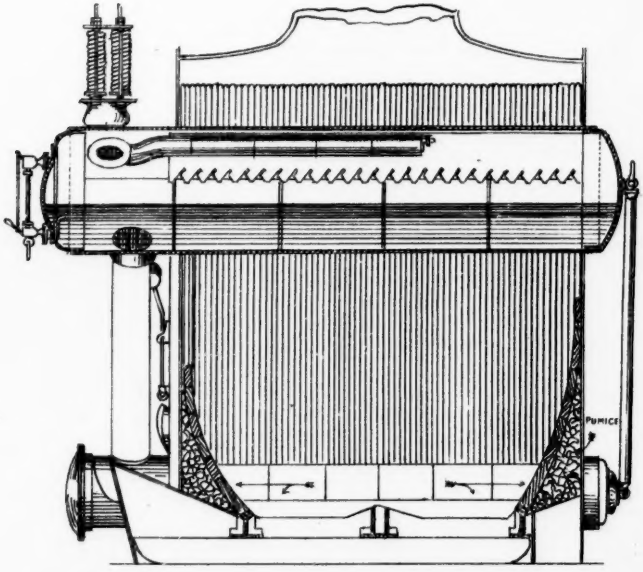
4th Group.

THORNYCROFT BOILER (Original).



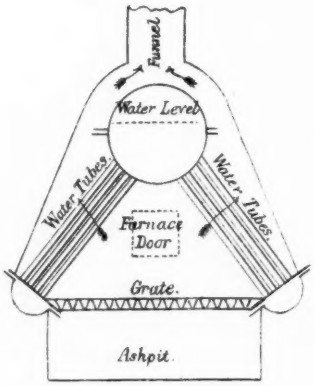




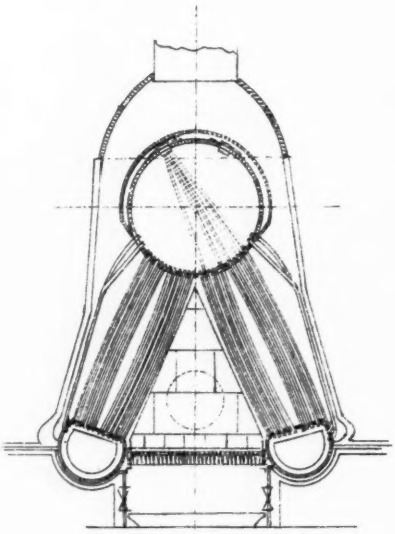


5th Group.

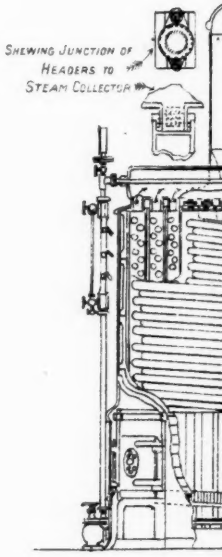
YARROW BOILER.



BLECHYNDEN BOILER.

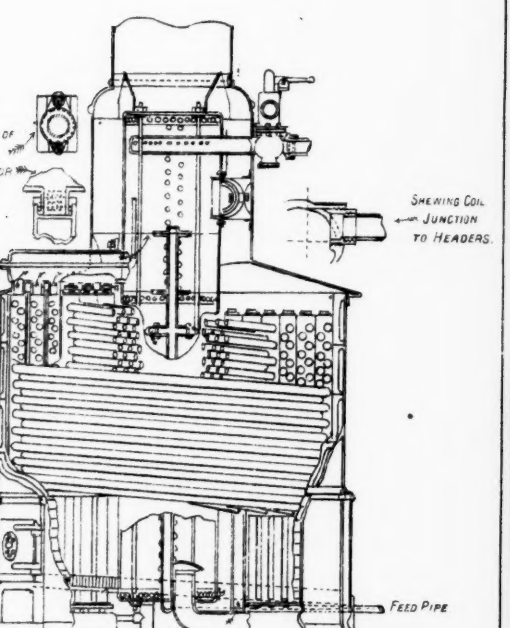


WARD'S



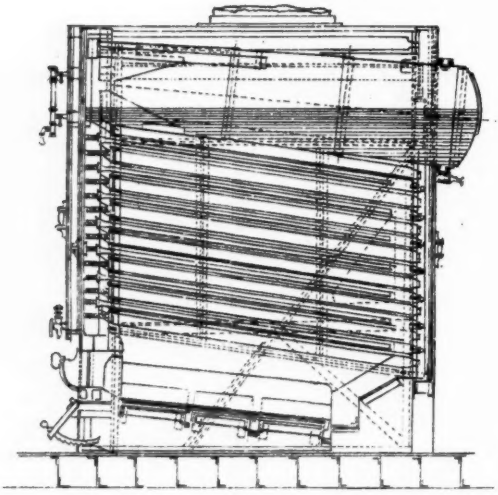
6th Group.

WARD'S SECTIONAL BOILER.

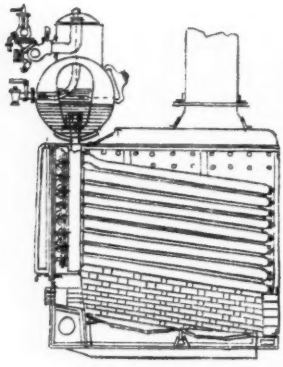


7th Group.

DÜRR BOILER with "Field" Tubes.

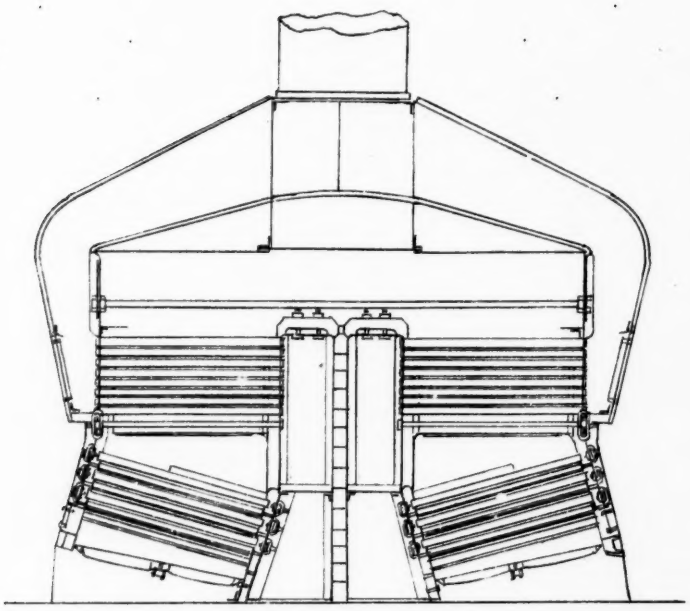


NICLAUSSE BOILER with "Field" Tubes.



8th Group.

LYALL BOILER.



NAVAL AND MILITARY NOTES.

NAVAL.

HOME.—The following are the principal appointments which have been made: Rear-Admiral—Ernest Rice to be Vice-President of the Ordnance Committee, vice Rear-Admiral H. Cleveland, placed on Retired List. Captains—G. W. Russell to "Sybille"; J. A. T. Bruce to "Cormorant," as Senior Officer at Gibraltar; J. Durnford, D.S.O., to "President," as Captain of Royal Naval College, Greenwich; W. H. May to "Ramillies," additional for service as Chief of the Staff; and A. G. McKechnie to "Asia." Commanders—M. Napier to "Wild Swan," E. J. Slade to "Cockatrice," H. B. Jackson to "Defiance," A. B. Grenfell to Keyham College, W. H. Somerset to "Raven," and E. Bain to "Hibernia."

The appointment of Captain W. H. May as Chief of the Staff to the Admiral Commanding the Mediterranean Fleet is certainly a step in the right direction, and we only wonder that an appointment has not been made before this; for many years past in the French Navy, and the custom also obtains in the German Navy, a chief of the Staff has been allowed to all Admirals, an appointment additional to, and quite distinct from, the Captain Commanding the Flagship.

The new first-class cruiser "Sybille" has been commissioned for service on the Mediterranean Station, while the "Wild Swan" proceeds to the Pacific to relieve the "Champion"; the "Crescent" has left China and arrived at Sydney with the new crew for the "Orlando"; the third-class cruiser "Brisk" is to be re-commissioned at Aden for a further term of service in the East Indies, her relief crew is now *en route* in the "Tyne"; the "Achilles" takes out men for the "Cockatrice," which will re-commission at Malta for further service in the Danube; the first Reserve ships "Edinburgh" and "Galatea" are changing districts and crews, the "Edinburgh" relieving the "Galatea" at Queensferry, and the latter coming to Hull; for the purposes of manning and repairs, the "Galatea" will now become a Chatham ship," while the "Edinburgh" will go to Portsmouth; the new first-class gunboat "Dryad" is to be commissioned for service on the Mediterranean station, and will relieve the "Gannet."

To the first-class cruiser "Blenheim," attached to the Channel Squadron, was allotted the duty of conveying the remains of Sir John Thompson, late Premier of Canada, to Halifax; the ship left Spithead at 9 a.m. on Sunday, the 23rd ult., and arrived at her destination on the morning of the 1st inst.

Two more of the new torpedo-boat destroyers were launched last month, the "Conflict" from the yard of Messrs. White, at Cowes, and the "Dragon" by Messrs. Laird Bros., at Birkenhead.

The great event of last month in Naval matters was undoubtedly the floating out of the "Magnificent" at Chatham, on Wednesday, the 19th ult., exactly a year and a day after her first keel plates were laid. It is undoubtedly a record performance in shipbuilding, and the Chatham dockyard officials have a right to be proud of their work. We have already given some details of the new battleships, of which the "Magnificent" is the first to take the water; but the following detailed account of the new vessel published in the *Times* may prove of interest to many readers, who may not have the opportunity of seeing that journal:—

"The first-class barbette battleship 'Magnificent,' which was floated out of dock on Wednesday, at Chatham, possesses more than usual interest. In the first place, she is the first ship of a new type, of which seven are to be built, and as a first-class battleship now costs not far from a million sterling, the country may

well look with some anxiety upon her chances of turning out a successful vessel. The modern practice of building war vessels in groups—or rather this return to the ancient practice—has much to recommend it from a tactical, as well as a strategic, point of view. It is no less advantageous to the warship designer, and at the same time it greatly reduces expenditure, for it is a sound engineering maxim that a single article is always far more costly to produce than if it form one of a group.

"The 'Magnificent' has been designed by Mr. W. H. White, C.B., the Director of Naval Construction. She was laid in No. 7 dry dock in Chatham yard on December 18th, 1893, so that she has been just one year in being brought to a state in which she can be floated. Such a speed of building is, we believe, unprecedented in the annals of warship construction, and most certainly excels anything accomplished in former days by a Royal dockyard. When the 'Royal Sovereign,' the prototype of the 'Magnificent,' was completed sufficiently to be floated out of dock in a little short of seventeen months the feat was looked upon as altogether remarkable. It was doubtless the praise Portsmouth got through the 'Royal Sovereign' that has led Chatham to do her very best to beat the previous record, for there is now a good deal of healthy rivalry between the two yards. The result of this rivalry is a decided gain for the country, for not only is there a money saving in quick construction, but the rapidity with which war material can be produced if danger threatens is an important factor in the military resources of the State. We have, therefore, to thank Admiral Morant, the superintendent of Chatham Yard; Mr. J. A. Yates, the chief constructor; and Mr. H. Cock, the constructor on the work, for setting such a high standard in this respect.

"The 'Magnificent,' in virtue of her rapid construction, becomes the first of a new type of warship, for though she closely resembles the 'Royal Sovereign' in many essential particulars, there are some radical changes from the design of the latter vessel. Seven of these costly vessels appear in the current Estimates, and though the full details of all are not quite settled, they will doubtless vary very little in design. The length of the 'Magnificent' is 390 feet between perpendiculars, the breadth 75 feet, and the mean draught 27 feet 6 inches, there being a difference of 1 foot between the forward and after depth of immersion. The displacement of load draught is estimated at 14,900 tons. The engines, which have been contracted for by the well-known firm of Messrs. John Penn and Sons, are designed to give off 10,000 indicated horse-power with natural draught, and 2,000 horse-power more with the induced draught, which takes the place of forced draught in this ship. The maximum estimated speed is 17½ knots, and 16½ knots with natural draught. The gun armament will consist of four 12-inch breech-loading guns, twelve 6-inch quick-firing guns, sixteen 12-pounder quick-firing guns, two 12-pounder boat and field guns, twelve 3-pounder quick-firing guns, and eight 0·45-inch Maxim guns. In addition to this there will be four submerged torpedo discharges, and one above-water tube at the stern. These are for the 18-inch torpedoes. The armour varies from 14 inches to 8 inches on the sides and citadel, and is 6 inches on the casemates, whilst the protective deck is from 2½ inches to 4 inches thick. The total stowage for coal is 1,800 tons, which will give a coal endurance at 10 knots of 28 days. The coal carried at the load draught is 900 tons. There will be two military masts, with two fighting-tops on each. In the tops are placed eight 3-pounder quick-firing guns and three search-lights. The weight on the keel-blocks at time of floating is calculated at about 6,000 tons, the total weight of the hull being put down at 10,180 tons. The total estimate for the hull is £627,500. The complement of officers and men, including the admiral and staff, will be 757.

"These are the chief elements of design as furnished by the dockyard authorities, and it will be interesting if we briefly compare them with the eight battleships of the 'Royal Sovereign' class, as provided by the Naval Defence Act. It will be seen by such comparison that the 'Magnificent' has a greater length by 10 feet than the 'Royal Sovereign,' though the breadth and draught of water are

the same. The new vessel will carry her heavy guns about 4 feet higher above the water level, and the freeboard is correspondingly increased. As the principal armament of the 'Royal Sovereign' was at an elevation of 23 feet above water, it may be taken that the 'Magnificent's' big guns will be 27 feet from the water-line. This is a great advance on the height of 14 feet of the 'Trafalgar's' heavy guns, and approaches the enormous height of 32 feet 8 inches, at which the Italian war-vessel 'Italia' carried her four 110-ton guns. It should be stated, however, that beneath the barbettes in which the latter vessel's monster armament is placed there is no armoured protection, so that a shell could find its way beneath them without obstruction, whilst in the three British warships referred to there is efficient armour protection beneath the heavy armament. Although it is a most important advantage to have a high and commanding gun position, probably no designer, in the present day of quick-firing guns and high explosives, would think of mounting important weapons upon unarmoured sides.

"It is in the disposition of armour that the 'Magnificent' differs most essentially from our former class of battleship. The total weight of armour worked into the hull is greater than in the 'Royal Sovereign," and the armour itself is of a more efficient kind. In the older ship compound plates were used, but in the 'Magnificent' the new Harveyized armour has been applied. The process of Harveyizing, which comes to us from the United States, may be described as giving a very hard and comparatively highly carburized face to a plate originally of a homogeneous mild nature. It was long thought by many metallurgists that it would be impossible to preserve the proper curves of plates during the process, and it is needless to say that this would have been fatal to using them for the exterior of the under-water part of ships. Those who have seen the plates of the 'Magnificent' will acknowledge that this difficulty has been overcome, for the armour works in very perfectly, preserving the lines of the vessel.

"The 'Magnificent' shows a very large area of side protection—in fact, the ship may be described as side-armoured in contradistinction to the term belted. In the 'Royal Sovereign' a belt of armour, having a maximum thickness of 18 inches, extended over two-thirds the length of the vessel, joining the two barbettes. This belt had a vertical extension of 8½ feet. Above this belt, to a height of about 9½ feet above water, was placed 5-inch armour for a great part of the length, to afford protection to the secondary armament. In the 'Magnificent' there are two pear-shaped barbettes as in the 'Royal Sovereign,' and on the side of the ship there are two tiers of armour-plates, 9 inches thick. These form a protected side extending about 10 feet above the water-line and about 6 feet below. We have thus a vertical extension of about 16 feet of armour 9 inches thick in place of the 18-inch and 5-inch armour in the 'Royal Sovereign' class. The change bears evidence to the growing appreciation of the value of rapid fire and high explosive shells, as well, perhaps, as advance in the manufacture of armour-plates. Whereas a few years ago the warship designer devoted most of his capital in displacement to a thick armoured belt of small area, designed to prevent penetration by the few heavy projectiles; he now fears rather the rapid destruction of large areas of side by smaller shot and shell projected with immense rapidity. The barbettes in the 'Magnificent' have 14-inch armour, the side armour being brought round them so as to protect the gun positions. The arrangement here differs from that of the 'Royal Sovereign' class, but the details are not very clear at the present state of the work.

"Another bold departure in this ship is the arrangement of armoured deck. This, in place of connecting the tops of the belt on each side of the ship, runs from the bottom edges of the side armour. It, therefore, joins the side of the ship be ow the water-line, but being steeply curved at the sides, it quickly rises above the water plane. The triangular space above the deck where it dips below the water will be filled with some water-excluding substance, so that if the side is pierced

and the deck remains uninjured, water will not flow in. The usual armour shelf for supporting the side armour is not necessary with this arrangement, as the bottom edge of the vertical armour rests on the outer extremity of the deck. The support to the side armour is very efficient. It consists, firstly, of about 4 inches of teak, at the back of which are two thicknesses of skin plating. The framing at the back of the armour consists of deep web frames strengthened by reverse angles. These frames extend vertically from the main deck, past the middle deck, to the lower edge of the armoured deck, being attached to the deck beams by large bracket plates, the whole forming a structure strong enough to resist the blows of hostile projectiles, yet comparatively light. At the present stage of construction this part of the design can be well seen, and it forms a feature to be examined with interest by all engineers and naval architects who have an opportunity of visiting the ship."

The vessel on the outside, before the water was admitted to the dock, presented the usual appearance of ships of this class. At the time of floating out all the armour-plates were in place but four. Bilge keels have been fitted for about two-thirds the length of the ship; they are about 3 feet deep and formed of double plating, with wood between, in the usual manner, and are attached by a continuous angle-bar on each side. The ordinary bracket-frame system has been followed in the double bottom, and the outer plating at the bow is made up to about 3 inches thick from the attachment to the ram for about 15 to 20 feet aft.

"There are in the arrangement of the principal armament some new features introduced since the 'Royal Sovereign' was designed. Firstly, the big guns are of the new 12-inch design in place of the 13½-inch guns of the older ship, so that a smaller weapon has been accepted. There are, however, two more 6-inch quick-firing guns, twelve in place of ten, and the protection of these guns has been carried out more completely than in the former ship. In addition to this, 12-pounder quick-firing guns have taken the place of the 6-pounders of the 'Royal Sovereign.' The change in armament as well as in armour also bears evidence of the increased importance attached to a large number of smaller projectiles and the expectation of increased probabilities of close action. Returning to the principal armament, we find that an axial ammunition trunk has been provided, so that the charge can be brought up from the magazines below when the guns are in any position of training. This central hoist is in addition to the fixed position, and therefore in action the captain would have the option, after firing a round, of bringing his guns back into the ordinary loading position or keeping them on the object until ready to fire again. There are advantages in both methods of working, which, however, it would be out of place to discuss here.

"There is not much that is of special interest to be said about the machinery of the 'Magnificent' beyond the important fact that a large experiment is to be made in the application of induced draught. As is well known, the usual means of obtaining a very high efficiency from the engines of warships is to close the stokeholds and maintain a *plenum* in them by means of rotary fans, thus driving a large volume of air through the fires. With induced draught, which is by no means a new thing, the fans are placed in the chimneys and are so run as to draw the air through the furnaces by reducing the atmospheric pressure in the uptakes and chimneys. The advocates of this system claim considerable advantage for it; but these claims many engineers do not consider founded on strong reasoning. The point is one that cannot be settled by abstract reasoning, and may well be left until the 'Magnificent's' trials give firmer basis of fact upon which to found opinion, although it should be stated in passing that certain trials already made have resulted in records being tabulated in favour of induced draught.

"The two sets of propelling engines are of the ordinary inverted three-stage compound condensing type, the cylinders being 40 inches, 59 inches, and 88 inches in diameter respectively, by 51-inch stroke. They have been constructed by Messrs. John Penn and Sons, of Greenwich, and are very fine specimens of marine

engineering; possessing all the most approved modern fixtures of steel castings and forgings, in place of cast or wrought iron, in positions where additional lightness and strength can be obtained by such charge. The twin propellers are of gun-metal, and are 17 feet diameter and 19 feet 9 inches pitch. The usual auxiliary machinery, electric light machinery, and boat-hoisting winches will also be supplied by Messrs. Penn and Sons. The boilers are eight in number, and are of the ordinary marine type, being 16 feet 1 inch diameter, and 9 feet 3 inches long, each containing four furnaces. The working pressure will be 150 lbs. per square inch. The main steam pipes will be of steel."

The official trial of the new torpedo-boat destroyer "Ardent" was made on Saturday, 15th ult. The vessel had been previously taken down from Chiswick to Greenhithe; she was steamed at an easy speed through the more crowded upper reaches until off Southend, when the stokehold hatches were closed and the forced draught put on. The measured mile on the Maplin Sand was soon reached, and six runs were at once commenced. The flood was making, so that the first run was against tide, the time occupied being 2 minutes 22 seconds. The revolutions were 393 per minute for the starboard engines and 397 for the port. The next run, with tide, was made in 1 minute 59 seconds, the revolutions being 390 and 400 for the starboard and port engines respectively. The next two runs against tide were rather better than the first, the time for each being 2 minutes 19·4 seconds, but the corresponding runs with tide were not quite as good as the first. The maximum revolutions during the trial for both sets of engines were made on the third run, the rate being 404·6 per minute for the starboard and 406·7 for the port engines. The mean speed for the six runs was 27·843 knots. The contract conditions for these boats are for a three hours' run, and the remainder of the time was occupied in steaming between the Mucking Light in Sea Reach and the Mouse lightship in the Swin. The mean speed on the whole run was just on 28 knots, actually 27·971 knots. The speed contracted for under trial conditions was 27 knots. The mean steam pressure was 196 lbs. per square inch, the mean vacuum 26¾ inches, and the mean air pressure for forced draught 2¾ inches of water. The aggregate indicated horse-power worked out about 4,350. The speed is short of that attained by the same vessel on a trial made last month, when a mean of 29·182 knots was obtained on two runs on the measured mile, with and against tide. That, however, was on a preliminary unofficial trial, when the full contract weight of armament and stores was not carried. The following is a copy of the official time records:—

—	Times.		Speed.	Revolutions.	
				Starboard Engines.	Port Engines.
	min.	sec.	knots.		
1	2	22	25·352	393·8	397·1
2	1	59	30·252	390·7	400·8
3	2	19·4	25·825	404·6	406·7
4	2	1·2	29·703	390·1	391·1
5	2	19·4	25·825	398·9	402·9
6	2	0·8	29·801	390·3	398·8

In comparing the speeds of these vessels it is necessary to note whether the trial is "official" or preliminary, as the weight carried largely influences the result. On the previous occasion however, the performance was somewhat better, as the power developed was about 5,000 indicated horse-power, both the piston speed and steam pressure being greater. On Saturday the weather was unfavourable, the wind being of a force from four to five. Though off shore, it was across the tide, making a short, steep sea, which the Admiralty officials

estimated took off a quarter of a knot from the speed. At the conclusion of the speed trial the usual turning trials were made, the vessel performing circles ahead and astern.

In the Home Notes of the December Journal, we stated that a number of 18-inch torpedoes (17 feet 6 inches long) had been sent to the factories and reduced in length to suit the dropping gear for boats; we are informed, however, on competent authority, that this is a mistake, no 18 inch torpedoes having been shortened that way, it not being possible to shorten the air chamber. The short 18-inch torpedo was introduced as a separate type 12 feet long, instead of 17 feet 6 inches.

FRANCE.—The following are the principal promotions and appointments which have taken place: Rear-Admirals—Touchard to be Member of the Superior Council of Statistics, de Penfentenyo de Kervéréguin to be President of the Permanent Commission of Control, Turquet de Beauregard to command of a Division of the Squadron of the Reserve in the Mediterranean. Capitaines de Vaisseau—Charpentier to command of Central ship of Reserve at Brest, Juhel to "Amiral-Duperré," Billard to "Redoutable," Lormier to "Cécille." Capitaines de Frégat—Lamson to "Forbin," Massenet as Chief of the Staff to Rear-Admiral Turquet de Beauregard, Lapotaire to "Nielly," Fouet to "Faucon."—*Le Moniteur de la Flotte.*

The trials of the new 2nd class cruiser "Friant," at Brest, are proceeding satisfactorily. With an indicated horse-power of 8,500, a speed of 18·5 knots was obtained; with an indicated horse-power of 3,500, the speed was 15 knots, the consumption of coal per horse-power per hour being 662 grammes; on a further trial for six hours—the engines developing 1,650 indicated horse-power—the mean speed was 11·8 knots. The "Chasseloup-Laubat," a sister ship, has also been continuing her trials successfully at Cherbourg. With eighteen boilers alight out of twenty, over 9,000 indicated horse-power was developed (the contract horse-power being 9,000) a corresponding speed of 18·2 being obtained. The armoured-cruiser "Latouche-Tréville," at Cherbourg, has made another three hours' trial, which was more satisfactory than the previous one. The contract indicated horse-power was reached with a speed of 17·5 knots. Some further modifications are being made in her machinery and with a view of improving the ventilation in her engine-room and stokeholds, the heat being still excessive, and it is hoped that her further trials will prove successful. The new torpedo-aviso "Fleurus" has broken down completely on her trials. She has been placed in the second category of the Reserve, and the contractors have been informed that new boilers must be provided. The coast-defence ship "Furieux" has been placed in the Reserve at Cherbourg, as some important modifications are to be made in her armour. The departure of the new torpilleur-de-haute-mer "Lansquenet" for the Mediterranean has been postponed. New ventilators are being fitted and some slight modifications made in her machinery, and it is intended to have some fresh trials, when, it is hoped, her speed will more nearly approach the 27 knots, which at one time it was confidently expected she would attain. At her last trials the mean speed maintained was only 24 knots.

The Minister of Marine has fixed the number of officers to be placed on the list for promotion during 1895 as under:—For Capitaine de Vaisseau, 12; for Capitaine de Frégate, 12; for Lieutenant de Vaisseau, 12.

It has also been decided that the training frigate "Melpomène" shall be re-commissioned as the seagoing training ship for seamen. The vessel will make two cruises during the year, each lasting four months and a half, and the contingent of men under instruction on each occasion will be 300. A certain number of apprentices training for the Merchant Navy will be received on board and form a special section.

During the last two years the instruction of seamen has been carried on on board the ships of the flying squadron, but the results apparently have not been satisfactory, so the Chief of the Staff has advised a return to the old system, that is, to commission a ship specially for training purposes. In consequence of this change, the rôle of the flying division, which has also been serving as a training squadron, will be modified, and as its duty for the future will be simply to protect the Fisheries off Iceland and Newfoundland, it is probable the squadron will be abolished and Newfoundland and Iceland reconstituted into a special station. It is further proposed to re-commission a ship specially to serve as a training school for pilotage.—*Le Moniteur de la Flotte, Le Yacht,* and *Le Temps.*

We had intended deferring our description of the new battleship "Brennus" until after the completion of her trials and her joining the Mediterranean fleet, but having gone to the expense of reproducing in collotype a photograph of the ship, before the extensive alterations to her super-structure were determined on, we have decided to let it appear in this issue of the Journal, as it may possibly interest naval men to see the ship as she was originally completed.

The principal dimensions of the vessel are as follows:—Length, 374 feet; beam at water-line, exclusive of armour, 66 feet 10 inches; displacement, 10,000 tons; mean draught, about 26 feet 3 inches; indicated horse-power, 13,500; estimated speed, 17·5 knots. She differs from the usual design of French battleship, as she has a straight stem and lower freeboard (except "Hoche") forward and aft. Protection is afforded by a complete steel belt 17·7 inches thick amidships, tapering to 9·8 inches and 11·8 inches at bow and stern, and rising 1 foot 8 inches above the water line; above this again is another streak of armour 4 inches thick, extending to a height of 4 feet 8 inches forward and 3 feet 9 inches aft. The armament consists of three 34-centimetre (13·4 inches) guns, two of which are mounted in a turret forward protected by 17·7-inch armour, and the third singly in a turret aft protected by 15·7-inch armour; ten 16-centimetre (6·3 inches) quick-firing guns, six of which are mounted in a central redoubt protected by 4-inch armour, and the remaining four singly on top of the redoubt, two each side in closed revolving turrets; four 67-millimetre, eight 47-millimetre, nine 37-millimetre, quick-firing guns; and five torpedo discharges; the small turrets are mounted on hydraulic pivots, and have steel armour 4 inches thick. The armoured deck is from 2·8 inches to 3·1 inches thick, and there are, in addition, two coffer dams filled with cellulose, which run the whole length of the ship's side; the first is under the armour belt, while the second is on the main deck and rises to a height of 4 feet above it.

According to the Naval Budget of last year the ship should have completed her trials and joined the Active Division of the Mediterranean fleet before the end of December, but her steam trials did not come up to expectation, the coal consumption was very great, and the speed fell short by more than a knot of what was contemplated by her designers; the trials for stability, which followed, were equally unsatisfactory, and the result is, as we mentioned in last month's Notes, that the superstructure is to be practically removed and one of the military masts to be dispensed with; as her mean draught was much deeper than was designed, the removal of so much dead weight will tend to remedy this last defect, besides adding materially to her speed.

We have mentioned in previous Notes that the Estimates for New Constructions in 1895 had undergone various modifications since they were first placed before the Chamber some eight months ago, but they have now been finally settled. It was originally intended that seventy-three vessels in all were to be on the stocks, completing, afloat, and on trial, during the present year; the list included nine battleships, three coast defence armour-clads, seven first-class cruisers, ten second-class cruisers, three third-class cruisers, two torpedo cruisers,

two avisos, two torpedo-avisos, one gunboat, seven torpilleurs-de-haute-mer, twenty-three first-class torpedo-boats for coast defence, three second-class torpedo-boats for embarkation on board ship, and one submarine boat. Of this number there were to be laid down seven, viz., one first-class cruiser, the "Jeanne d'Arc," one second-class cruiser E^4, two torpilleurs-de-haute-mer "Mangini" and "Tenare," two first-class torpedo-boats P^{10} and P^{11}, and one torpedo-boat for embarkation.

According to the new programme, eighteen vessels will be laid down as follows:—Two first-class cruisers of high speed (commerce destroyers); one second-class cruiser, E^4; two third-class cruisers, K^1 and K^2; two torpilleurs-de-haute-mer, "Mangini" and "Tenare"; five first-class torpedo boats, P^{10} to P^{14}; five torpedo boats for embarkation, R^4 to R^8; one first-class battleship, A^7, to be built at Brest; making a grand total of eighty-four ships building, completing, and undergoing trial. The new battleship is to cost 27,513,366 francs and be completed in 1899. Full details concerning her have not yet been made public, but it is almost certain that she will be similar to the "Charlemagne" and "Saint Louis," with, perhaps, some modifications, with a tonnage displacement of about 11,200 and engines developing under forced draught 14,500 indicated horse-power, with an estimated speed of eighteen knots; 1,181,785 francs is to be expended on her during the current year. The new Aviso, S^2, is also to be built in one of the dockyards and will cost 2,407,188 francs, and is to be completed in 1897. She will be built of steel, with wood sheathing, have a displacement of about 1,243 tons, engines of 2,200 indicated horse-power and a speed of fifteen knots; will be 221 feet long, with a beam of thirty-four feet, and have for armament one 138 millimetre (4·7 inch), five 100 millimetres (3·9 inch), and seven 1·7 inch guns, all quick-firing; 287,660 francs will be expended on her during the current year. The two new fast first-class cruisers, N^1 and N^2, will be built at private yards, and will each cost 18,369,130 francs, of which sum 700,000 francs will be expended during 1895. They are to be completed by the end of 1898. Full details are not yet to hand, but it is probable their displacement will be between 8,500 and 9,000 tons, their engines to develop 26,000 indicated horse-power, the coal stowage about 1,500 tons, which will give a steaming radius of 7,500 miles at twelve knots. They are to have three screws. The second-class cruiser E^4 will cost 8,233,125 francs, has been designed by M. Tissier, is to be a sister-ship to the "Catinat," and to be completed in 1898. Her dimensions will be as follows:—Length, 321 feet 6 inches; beam, 44 feet 6 inches; displacement, 4,065 tons, with a mean draught of 19 feet 6 inches. Engines with Belleville boiler, to develop 9,000 I.H.P., and give an estimated speed of 19 knots; the coal stowage will be 571 tons, giving a radius of action of 6,000 miles at 10 knots; the ship will be wood-sheathed and coppered. Her armament will consist of four 16-c.m. (6·1 inch) and ten 4-c.m. (3·9 inch) quick-firing guns, with eighteen small quick-firers. The eighty-four vessels under construction or on trial during 1895 are divided as follows:—

Nine battle-ships, three coast-defence armour-clads, eight first-class cruisers, ten second-class cruisers, five third-class cruisers, one torpedo-depôt-ship, one torpedo-cruiser, two torpedo-avisos, two avisos, one gunboat, seven torpilleur-de-haute-mer, twenty-six first-class torpedo-boats, eight torpedo-boats for embarkation, and one submarine boat.

Of these ships twenty-three are being or to be constructed at the dockyards, and sixty-one (including forty-one torpedo-boats) in private yards. In the dockyards will be constructed or completed seven battle-ships, three coast-defence armour-clads, three first-class cruisers, six second-class cruisers, one torpedo-cruiser, two avisos and one submarine boat; in private yards two battle-ships, two coast-defence armour-clads, five first-class, four second-class, and two third-class cruisers, one torpedo-depôt-ship, two torpedo-avisos, one gunboat, seven

torpilleur-de-haute-mer, twenty-six first-class torpedo-boats and eight torpedo-boats for embarkation will be in different stages of completion.

In 1895 the following ships should be ready for their trials :—The first-class battle-ship "Janréguiberry," coast-defence ship "Trehouart," the cruisers "Bugeaud," "Bruix," "Descartes," "Cassini," Casabianca," and torpedo-depôt-ship "Foudre." In 1896 the battle-ships "Charles-Martel" and "Carnot," the armoured-cruiser "Pothuau," the cruisers "D'Assas," "Duchayla," "Galilée," "K[1]," and "K[2]" ought to be completed. In 1897 the battle-ships "Massena" and "Rouvet," the first-class cruiser "D'Entrecasteaux," the cruisers "Catinat," "Pascal," "Cassard," and "Lavoisier" are to be ready.—*Le Yacht* and *Le Moniteur de la Flotte.*

ITALY.—The following are the principal promotions and appointments which have been made :—Rear-Admirals R. Corsi and G. Magnaghi to be Vice-Admirals. Vice-Admirals N. Canevaro to be Commander-in-Chief of the 3rd Maritime Department (Venice), F. Labrano placed on retired list (*Posizione di servizio ausiliario*). Rear-Admirals C. de Liguori and S. Marra placed on retired list; G. Palumbo relieved from command of Training Division Rear-Admiral C. Puliga Quigini, second in command of the Reserve Squadron, has transferred his flag from the "Dandolo" to the "Sardegna."—*Gazzetta Uffiziale.*

The Permanent and Reserve Squadrons were reorganised as follows from the 21st October last :—

PERMANENT SQUADRON.

1st Division.—Battleship: "Lepanto," bearing flag of Vice-Admiral Racchia, Commander-in-Chief.
Cruisers: "Stromboli," "Montebello," and "Iride."

2nd Division.—Battleship: "Morosini," flag-ship of Rear-Admiral Cobianchi.
Cruisers: "Etruria," "Euridice," and "Calatafimi." The tank-ship "Tevere" and six Torpilleurs-de-haute-mer, Nos. 63, 103, 133, 113, 111, and 137.

RESERVE SQUADRON.

1st Division.—Battleships: "Re Umberto," bearing the flag of Vice-Admira Accinni, Commander-in-Chief, "Andrea Doria."
Cruiser: "Aretusa."

2nd Division—Battleships: "Sardegna," flag-ship of Rear-Admiral Quigini, "Ruggiero di Lauria."
Torpedo-avisos: "Nibbio," "Aquila," "Sparviero," and "Falco."
Torpilleurs-de-haute-mer—12: Nos. 116, 125, 62, 104, 124, 110, 146, 153, 144, 127, 154, 74.

The following vessels are also under the command of the Vice-Admiral commanding the Reserve Division:—The spar-decked corvette "Caracciolo," training-ship for boys, with her tenders, the "Miseno," "Palinuro," "Chioggia," and "Capraia"; the battleships "Italia," gunnery-schoolship; "San Martino," torpedo-schoolship; "Formidabile," tender to gunnery-ship; and the torpedo-aviso "Goito," tender to torpedo-school ship. In commission on foreign service are: Cruisers—"Piémonte," "Liguria," "Umbria," and "Minerva"; the spar-decked corvettes "Flavio Gioia" and "Christoforo Colombo," training-ships for cadets and boys. For special service, the "Citta di Milano" and "Volta."

The Central ships for local defence are: The battleships—"Maria Pia," at Spezzia; "Castelfidardo," at Maddalena; and the "Ancona," at Tarentum; with the despatch-vessel, "Staffetta," at Venice.

In last month's Notes we mentioned that the Minister of Marine had adopted a new system of classification for the ships of the Fleet; the accompanying table will show not only how the ships are now classed, but also the different ports to which they are severally attached :—

	1. Maritime Department. **(Spezia).**	2. Maritime Department. **Naples and Tarento.**	3. Maritime Department. **Venice.**
	Battleships and Armoured Cruisers.		
1. Class. over 9000 *t* D.	Italia, Lepanto, Re Umberto, Sicilia, Sardegna, Duilio, Dandolo, R. di Lauria, F. Morosini, A. Doria, Ammiraglio di S. Bon, E. Filiberto.		
2. Class. 6000 – 9000 *t* D.		Carlo Alberto, Vittor Pisani, G. Garibaldi, Varese.	
3. Class 4000 – 6000 *t* D.	Castelfidardo, Maria Pia, S. Martino	Ancona, Affondatore	Marco Polo.
	Cruisers.		
4. Class 3000 – 4000 *t* D.			G. Bausan, Etna, Vesuvio, Stromboli, Fieramosca.
5. Class 2000 – 3000 *t* D.			Piemonte, Dogali. Lombardia, Liguria, Etruria, Umbria, Elba, Calabria Puglia.
6. Class 500 – 2000 *t* D.		Tripoli, Gioto, Monzambano, Montebello, Confienza, Partenope, Minerva, Aretusa, Urania, Euridice, Iride, Calatafimi, Caprera.	
	Torpedo Avisos.		
7. Class under 500 *t* D.	Folgore, Saetta		
	Torpedo Boats.		
1. Class over 100 *t* D.	Aquila, Avvoltoio, Falco, Nibbio, Sparviero		

	1. Maritime Department. (Spezia).	2. Maritime Department. (Naples and Tarento).	3. Maritime Department. Venice.
	Torpedo Boats.		
2. Class 60—100 *t* D.	60 *S*, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76 *Y*, 77, 78, 79, 80 *S*, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95 96, 97, 98, 99, 100.	101 *S*, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, and 126.	127 S 128, 129, 130 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146 147, 148, 149, 150. 151. 152, 153, 154.
3. Class 30—60 *t* D.	22 Y, 24 T, 25 Y, 26, T 31, 32, 36, 38, 44, 45, 46, 49, 50, 51, 52, 53, 56, 57, 58.	26 T, 27, 28, 33, 39, 40, 41, 42, 43, 47, 48, 54, 55, 59.	23 T, 30, 34, 35, 37
4. Class under 30 *t* D.	3 T, 4, 5, 6, 11, 18, 20	14 T, 17	1 T, 2 Y, 7 T, 8, 9, 10, 12, 13, 15, 16, 19, 21.
	Special Service Ships.		
1. Class over 4000 *t* D	Trinacria, Eridano		
2. Class 2500—4000 *t* D.	Formidabile, Savoia	V. Emanuele, F. Gioia, A. Vespucci, Terribile	Volta
3. Class 1000—2500 *t* D	Rapido, Messaggero, Caracciolo, C. Cavour, Washington, Europa, Citta di Milano	Scilla, Cariddi.	C. Colombo, Staffetta, Volturno, Curtatone, Governolo.
4. Class under 1000 *t* D	Garigliano, Atlante, Tevere	Vedetta, A. Barbarigo, M. Colonna, Castore, Polluce, Chioggia, Mestre, Murano, Verde, Pagano.	Archimede, Galileo, S. Veniero, A. Provana, Miseno, Palinuro, Sesia, Ercole.
	Vessels for Harbour Service.		
	Roma, Palestro, Citta di Genova, M. Adelaide, Venezia, Sentinella, Tino, Tremiti, Gorgona Capraia Luni, Rondine, Giglio, Tronto Bisagno Tanaro, Arno, Polcevera, Dora. Tugs: Nos. 2, 3, 4, 5, 6, 7, 8, 10, 12, 13, 14, 15, 16, 22 23, 24.	P. Amedeo, C. di Napoli, Saati, Guardiano Marittimo, Ischia, Laguna, Gazzella, Vigilante, Diligente, Magra, Sebeto, Adige, Ticino, Sarno, Po, Liri—Tugs. Nos. 9, 18, 19, 20, 21.	Lagoon Gunboats Nr. 1, 2, 3, 4, 5. 6, Mincio, Brenta, Sile, Tugs, Nos. 1, 11.

"*Mittheilungen aus dem Gebiete des Seewesens*" *nach* "*Italia Marinara.*"

The works at the new military port of Tarentum are being pushed on; but it is considered that the existing fortifications fall far short of what is necessary for the defence of the harbour and to prevent a *coup de main*. It is intended to construct, as soon as possible, the following works:—At l'Olmo, an upper battery of six mortars, with a lower battery in which will be mounted 28-centimetre and 25-centimetre guns; at the Chianca, at the inner end of the canal, a battery of four 6-inch quick-firing guns; at the Chateau Saint-Ange, towards the mouth of the canal a battery of mitrailleuses.

In order to complete the system of defence, it is further intended to build three moles; the first will narrow the entrance from the Mare Grandé to 1,510 yards; the second will close the channel now existing between the islands of San Paolo and San Pietro; while the third, starting from San Pietro island in the direction of point Hirondelle, will considerably diminish the width of the channel here.—*Le Moniteur de la Flotte.*

It is reported that the Minister of Marine has determined on removing the 100-ton M.L.R. guns from the "Duilio" and "Dandolo," and they will be replaced by B.L.R. guns of a much less calibre.

RUSSIA.—In the early part of last November two new battleships, the "Poltava" and "Petropavlofsk," were launched from the Admiralty yard on the Neva; they are sister ships, and a third, the "Sevastopol," is also under construction at the same yard. Their dimensions are as follows:—Length 375 feet, beam 70 feet; and, with a mean draught of 26 feet, they will have a displacement of about 11,000 tons; the engines of the "Poltava" are being made by Messrs. Humphreys, Tennant and Co., and for the "Petropavlofsk" by Messrs. Hawthorne, Leslie and Co., and they are to develop 10,600 indicated horse-power, with an estimated speed of seventeen knots. No definite information as to whether these ships will have a complete water-line belt is yet to hand, but we are informed by a retired officer, who has lately returned from St. Petersburg, and who was permitted to visit the ships before they were launched, that, like the "Tria Sviatitelia," building at Nicolaieff, they are improved "Camperdowns," with a belt extending from two-thirds to three-fourths of the length of the ship, the thickness of the armour being 16 inches amidships, tapering to 8 inches forward and aft. It is believed that the armament will consist of four 12-inch (67 ton) guns, mounted in pairs in two turrets, protected by 10-inch armour, one forward and one aft, and of twelve 6-inch quick-firing guns, mounted in pairs in sponsoned-out turrets in a central battery, each of which will give an arc of training of 135°; there will be further thirty-four small quick-firing guns of various calibres and six above-water torpedo discharges. With regard to the auxiliary armament of these ships, there is a later report to the effect that 8-inch quick-firing guns are to be substituted for the 6-inch.

Two new cruisers for the Volunteer fleet are being built by Messrs. Hawthorne, Leslie and Co. They are to be of the same type as the "Orel" and "Saratov," also constructed by the same firm, for the fleet, and to be able to maintain a sea-speed of nineteen knots. They will be named "Vladimir" and "Khabarosbk" respectively. It is stated that the number of steamers for the fleet is to be increased to fifteen; there are now twelve, including the two new ones building, and on their completion three more will be laid down.

The two new cruisers of the improved "Rurik" type, building at St. Petersburg, the "Rostilav," and "Rossia" are to be fitted with special furnaces to enable them to burn petroleum fuel.

Rear-Admiral Makaroff has succeeded Rear-Admiral Avelan, in command of the Squadron of the Mediterranean. The armoured cruiser, "Pamjat Azova," and the armoured gunboats, "Otvajny" and "Gremiastchi," have left for China.—*Le Yacht.*

Progress is being made with the new harbour works at Libau. The town is situated on a narrow neck of land between the sea and an inland sheet of water, the entrance to which forms the mercantile harbour, which will not, however, be in any way interfered with by the new arsenal and military harbour now under construction. Two large moles are being built which stretch for a distance of a little over a mile into this inland sea, there being a depth of some thirty-two feet at the entrance, while inside the moles the bottom will be dredged out to a uniform depth of twenty-nine feet. From this harbour a canal over a mile and a half long, 160 yards wide, and twenty-seven feet in depth, will be carried landwards, and on each side will be constructed two large basins, with an area of 200,000 square yards, round which will be built the docks and new dockyard establishments. The cost of the work will be enormous, and in any case years must elapse before the new dockyard can at all approach completion. Moreover, it is reported that grave difficulties are already being experienced in the dredging, as a stratum of rock has been reached, and should it prove to be of considerable extent, the whole harbour scheme may have to be reconsidered.—*Jahrbücher für die deutsche Armee und Marine.*

SWEDEN.—According to the Naval Estimates for 1895, Sweden possesses 17 armoured and 79 unarmoured ships, but among them are several vessels, which in the event of war would be of little or no use. The majority in the Chamber of Representatives have, however, for some time steadily refused to sanction the efforts of the Government for strengthening the Fleet, and every year considerable sums have been struck out of the Naval Budget. In 1894 a sum of two and a quarter millions of kronen was demanded for new constructions, but only one and a half millions was granted. In the Spring of the year before last, a Commission appointed to report on the plan for the reorganisation of the Fleet, proposed by the Government, recommended the building of some larger armoured ships, with a displacement of some 4,000 tons, and an armament of two 25-centimetre and four 12-centimetre guns, as well as the requisite number of small quick-firing and machine guns. The cost of each such ship was reckoned at 3,347,725 kronen. The Committee further recommended the building of some first-class torpedo boats, with a displacement of 90 tons. The present torpedo boats are only 65 tons, and their engines are far too weak. The cost of these vessels is estimated at 218,000 kronen each. Some smaller torpedo boats of less draught are also required, so that they can pass through the Stockholm-Gothenberg Canal between the North Sea and the Baltic. Finally the Commission recommended the building of a fast aviso and a troopship. The cost of these two ships would be 900,000 and 260,000 kronen respectively. As an annexe to this report sanctioned by the Government, the Ministry of Marine brought forward its new ship-building proposals. In the Naval Budget for 1895, a sum of 10,622,000 kronen (£599,800) is demanded, for laying down three first-class armoured ships, one aviso, ten first-class torpedo boats, six second-class torpedo boats, and a troopship. The time allowed for building these vessels is fixed at five years; last year a sum of two and a half millions was demanded, and a further sum of one million kronen was demanded for a battleship of an improved "Svea" type, which latter was approved. The whole cost of this last ship, including armament, is estimated at 3,347,725 kronen, and her dimensions are as follows:—Length, 267 feet; beam, 46 feet, a mean draught of 16 feet 6 inches. On a displacement of 3,400 tons, the engines are to develop 3,700 indicated horse-power, giving an estimated speed of 15 knots. The armament will consist of two 25-centimetre, and four 13-centimetre quick-firing guns, with sixteen small quick-firing and machine guns, and a bow tube for 14-inch torpedoes. The heavy guns will be mounted singly in turrets, fore and aft, protected by 12-inch armour, and the four 12-centimetre guns will be in a casemate two each side with 5-inch armour; the armoured deck is two inches

thick, and there is a partial water-line belt, rather more than half the length of the ship 12 inches thick. The three new projected ships are to be 400 tons larger, but it remains to be seen if the Reichstag agree to their construction.—(*Neue Preussiche Kreuz Zeitung.*)

MILITARY.

HOME.—With the increasing demands on the mobility of troops, and the difficulties of supply which the satisfaction of these demands entail, the importance of some portable form of food which will enable men and horses to endure extreme fatigue and privation has greatly increased. We, therefore, offer no apology for reproducing almost *in extenso* the following notes on a lecture delivered by Mr. Clements Markham at the Imperial Institution on the Cultivation and Properties of the "Coca" Plant. In the concluding paragraphs, Mr. Clements Markham calls attention to the deterioration of the leaves when stored. This deterioration undoubtedly occurs, but even with this inferior article of commerce we can from personal experience assert that the endurance of either man or horse can be rather more than doubled by the use of this leaf.

Personally, we prefer to use the Kola nut, which appears to possess identical qualities. This also deteriorates in the process of drying, but for private expeditionary purposes the full value of the fresh nut can be derived by using powders of theobromin, and caffeine, two grains of the former to eight of the latter.

COCA CULTIVATION.

Coca.—Since the coca leaf, another South American product, has been proved to possess great medicinal virtues, coca cultivation has become a subject well worthy of careful consideration by Indian and Colonial administrators. In years now long gone by, I had opportunities of learning something of that cultivation, and of experiencing the effects of the coca leaf; so it will perhaps be considered that, from some points of view, I may venture to address you as an authority on the subject. Since the discovery of the alkaloid, coca has become an important addition to the pharmacopœia; but it should be remembered that it had been for centuries a great source of comfort and enjoyment to the Peruvian Indians. It was much more than what betel is to the Hindu, kava to he South Sea Islander, and tobacco to the rest of mankind, for its use really produces invigorating effects which are not possessed by those other stimulants or narcotics

Cowley on the Coca Leaf.—Made known in this country to the very few students who were acquainted with the Spanish Chronicles during the 17th century, it is very curious to find that coca, and its virtues, were within the knowledge of Abraham Cowley, the poet of the days of Charles I. Mr. Martindale, who has written an excellent little book on coca and cocaine, refers to a very curious allusion to coca in the writings of Cowley (*Book V. of Plants*). Bacchus is supposed to have filled a bowl with the juice of the grape for Omelichilus, an imaginary American deity; on which the god of the New World summons his own plants to appear. Various fruits are marshalled on their branches, and Cowley even adds to his poetic description of the virtues of coca a prophecy which has now become true. Apostrophising the leaf, he says:—

"Nor Coca only useful art at home,
A famous merchandise thou art become."

Prejudice against Coca.—The Peruvians have used the coca leaf from the most ancient times. It was considered so precious that it was included in the sacrifices that were offered to the Sun, and the High Priest chewed coca during the ceremony. *Mitimaes*, or colonists, were sent down from their native heights among the Andes, to cultivate the coca plants in the deep valleys to the eastward, and the leaves were brought up for the use of the Incas of Peru. After the conquest of Peru, by the Spaniards, some fanatics proposed to proscribe its use and to root up the plants, because the leaves had been used in the ancient

superstitions, and because the cultivation took away the Indians from other work. The second Council of Lima, which sat in 1569, condemned the use of coca "as a useless and pernicious leaf, and on account of the belief stated to be entertained by the Indians that the habit of chewing coca gave them powers of endurance, which," said these sapient Bishops, "is an illusion of the evil one."

Anecdote respecting Coca.—The learned Jesuit Acosta, and the chronicler Garcilasso de la Vega, however, bear very different testimony. In speaking of the strength and endurance that coca gives to those who chew it, Garcilasso relates the following anecdote:—"I remember," he says, "an incident which I heard of a gentleman of rank and honour in my native land of Peru, named Rodrigo Pantoja. Travelling from Cuzco to Lima he met a poor Spaniard who was going on foot with a little girl on his back. The man was known to Pantoja, and they thus conversed: 'Why do you go laden thus?' said the Knight. The poor man said that he was unable to hire an Indian to carry the child, and for that reason he carried it himself. While he spoke, Pantoja looked in his mouth, and saw that it was full of coca. As the Spaniards abominated all that the Indians eat and drink, as though they savoured of idolatry, particularly the chewing of coca, which seemed to them a low and vile habit, he said—'It may be as you say, but why do you chew coca, like an Indian, a thing so hateful to Spaniards?' The man answered—'In truth, my lord, I detest it as much as anyone, but necessity obliges me to imitate the Indians and keep coca in my mouth, for I would have you to know that, if I did not do so, I could not carry this burden, while the coca gives me sufficient strength to endure the fatigue.' Pantoja was astonished to hear this, and told the story wherever he went. From that time credit was given to the Indians for using coca from necessity, to enable them to endure fatigue, and not from gluttony."

Spanish Rules as to Coca Cultivation.—Eventually, indeed, the Spanish Government interfered with coca cultivation from more worthy motives, and *quitas* (turns) of Indian labourers for collecting coca leaves were forbidden in 1569 on the ground of the reputed unhealthiness of the valleys. The Spanish Viceroy of Peru afterwards permitted the cultivation with voluntary labour, on condition that the labourers were paid and that care was taken of their health.

Descent to the Coca Plantations.—Coca has always been one of the most valuable articles of commerce in Peru, and it is used by about 8,000,000 of the human race. The plant (*Erythoxylon Coca*) is cultivated between 2,000 and 6,000 feet above the level of the sea, in the warm valleys of the eastern slopes of the Andes, where it rains more or less every month in the year. The descent from the bleak and lofty plains of the Andes to the valleys where the coca grows, presents the most lovely scenery to be found anywhere. For the first thousand feet of the descent the vegetation continues to be of a lowly alpine character; but as the descent is continued the scenery increases in magnificence. The polished surfaces of perpendicular cliffs glitter here and there with foaming torrents, some like thin lines of thread, others broader and breaking over rocks, others seeming to burst out of the fleecy clouds, while jagged black peaks, glittering with streaks of snow, pierce the mists which conceal their bases. Next the terraced gardens are reached, constructed up the sides of the mountains, the upper tier from 6 feet to 8 feet wide, and supported by masonry walls, thickly clothed with celsias, begonias, calceolarias, and a profusion of ferns. These terraces or *andeveria* are often upwards of a hundred in number, rising one above the other. Below them the stream becomes a roaring torrent, dashing over huge rocks, with vast masses of dark frowning mountains on either side, ending in fantastically-shaped peaks, some of them veiled by thin fleecy clouds. The vegetation rapidly increases in luxuriance with the descent. The river, rushing down the valley, winds along the small breadth of level land, striking first against the precipitous cliffs on one side, and then sweeping over to the other. The scenery continues to increase in beauty, and the cascades pour down in every direction, some in a white sheet of continuous

foam for hundreds of feet, finally seeming to plunge into beds of ferns and flowers; some like driven spray, and occasionally a waterfall may be seen high up, between two peaks, which seems to drop into the clouds below. Next bamboos and tree ferns begin to appear, and we at length reach the region where coca is cultivated in terraces, often fringed with coffee plants. In many places these terraces are fifty deep, up the sides of the mountains; the rock is a metamorphic slate, slightly micaceous and ferruginous, with quartz occurring here and there; the soil is a soft brown loam. The trees and shrubs in the coca region are very luxuriant; there are beautiful *melastomaceæ* with a large purple flower, cinchona plants of the shrub variety, gaultherias, and an immense variety of ferns.

Coca Cultivation.—The coca plant is a shrub from 4 to 6 feet high, with lichens usually growing on the older trunks. The branches are straight and alternate; the leaves alternate and entire, in form and size like tea leaves; flowers solitary, with a small yellowish-white corolla in five petals. Sowing is commenced in December and January when the rains begin, which continue until April. The seeds are spread on the surface of the soil in a small nursery or raising ground, over which there is generally a thatched roof. The following year the young plants are removed to a soil specially prepared by careful weeding and breaking up the clods very fine by hand. This soil is often in terraces only affording room for a single row of plants, which are kept up by sustaining walls. The plants are generally placed in square holes a foot deep, with stones on the sides to prevent the earth from falling in. Three or four are planted in each hole and grow together. In Southern Peru and Bolivia the soil in which the coca plants grow is composed of a blackish clay, formed from the decomposition of the schists which form the principal geological feature of the Eastern Andes. When the plantation is on level ground the plants are placed in furrows separated by little walls of earth, at the foot of each of which a row of plants is placed. But this is a modern innovation, the terrace cultivation being the most ancient. At the end of eighteen months the plants yield their first harvest; they continue to yield for upwards of forty years. The first harvest is called "*quita-calzon*" and the leaves are picked with extreme care, to avoid disturbing the roots of the young tender plants. The following harvests are called "*mitta*" ("time" or "season") and take place three times or even four times a year. The most abundant harvest is in March, immediately after the rains. The worst is at the end of June. With plenty of watering four days suffice to cover the plants with leaves afresh. It is necessary to weed the ground very carefully, especially while the plants are young. The green leaves, when harvested, are deposited in a piece of cloth which each picker (woman or child) carries, and are then spread out in very thin layers and carefully dried in the sun in yards paved with slate flags. The green leaf is called *matu*, and the dried leaf becomes coca. The thoroughly dry leaves are sewn up in 20-lb. *cestos* or sacks made of banana leaves, strengthened by an exterior covering of cloth. They are also packed in 50 lb. drums, pressed tightly down. Dr. Poëpping, a German traveller, some sixty years ago reckoned the profits of a coca farm to be 45 per cent. The harvest is largest in a hot moist situation; but the leaf which is generally considered the best flavoured by consumers, grows in drier parts on the mountain sides. The very greatest care is required in drying; for if packed up moist the leaves become fetid, while too much sun causes them to shrivel and lose flavour.

Coca Trade.—The internal trade in coca has been considerable, ever since the conquest of Peru, three-and-a-half centuries ago. Acosta says that in his time at Potosi, it was worth $500,000 annually, and that in 1583 the Indians consumed 100,000 cestos of coca, worth $2½ each in Cuzco, and $4 in Potosi. Between 1785 and 1795 the coca traffic was calculated at $1,207,430 in the Peruvian Viceroyalty, and at $2,641,487 including that of Buenos Ayres. In 1860 the approximate annual produce of coca in Peru was about 15,000,000 lbs., the average yield being 800 lbs. an acre. More than 10,000,000 lbs. were annually produced in Bolivia.

At that time the *tambor* or drum of 50 lbs. was worth $9 to $12, the fluctuations in price being caused by the perishable nature of the article. The average duration of coca in a sound state, on the coast of Peru, is about five months, after which time it is said to lose its flavour, and it is rejected by consumers as worthless.

Use of Coca.—No native of Peru is without his *chuspa* or coca bag made of llama cloth, which he carries over one shoulder, suspended at his side. In taking coca he sits down, puts his *chuspa* before him, and places the leaves in his mouth one by one, chewing them, and turning them with his tougue, until he forms a ball. He then applies a small quantity of carbonate of potash prepared by burning the stalk of the quinna plant, and mixing the ashes with lime and water; he thus forms cakes called *llipta*, which are dried for use and also kept in the *chuspa* or bag, sometimes in a small silver receptacle. With this there is also a small pointed instrument with which the *llipta* is scratched, and the powder is applied to the pellet of leaves. In some provinces a small calabash full of lime is kept in their *chuspas*, called *iscupuru*. The operation of chewing is usually performed three times during the day's work, and every Indian consumes 2 or 3 oz. of coca daily. In the mines of the cold regions of the Andes the Indians derive great enjoyment from the use of coca. The *chasque* or messenger, in his long journeys over the mountains and deserts, and the shepherd watching his flock on the lofty plains, has no other nourishment than is afforded by his *chuspa* of coca, *chunu* or frozen potato, and a little parched maize. The feats of Indian couriers, sustained by coca leaf, and a little parched maize, are marvellous. It is authentically recorded that an Indian has taken a message from La Paz to Tacna, a distance of 249 miles, with a pass 1,300 feet above the sea to go up and come down, in four days, thus accomplishing 60 miles a day. He rested one day and night at Tacna, and then returned.

Virtues of the Coca Leaf.—The reliance on the extraordinary virtues of the coca leaf amongst the Peruvian Indians is very strong. In the province of Huanuco they believe that, if a dying man can taste a leaf placed on his tongue, it is a sure sign of his future happiness. A common remedy for a headache is to damp coca leaves, and to stick them all over the forehead. My own experience of coca was very much in its favour. Besides the agreeable soothing feeling it produced, I found that when I chewed it I could endure long abstinence from food with less inconvenience than I should otherwise have felt, and that it enabled me to ascend precipitous mountain sides with a feeling of lightness and elasticity, and without losing breath. This latter quality ought to recommend its use to members of the Alpine Club, and to walking tourists in general. The smell of the coca leaf is agreeable and aromatic, and when chewed it gives out a grateful fragrance, accompanied by slight irritation, which excites the saliva. Tea made from the leaves has much the taste of green tea, and, if taken at night, is much more provocative of wakefulness. Applied externally, coca leaves moderate rheumatic pains. When used to excess it is, like everything else, prejudicial to health; yet, of all the narcotics and stimulants used by man coca is the least injurious, and the most soothing and invigorating.

Cocaine.—The active principle of the coca leaf was separated by Dr. Niemann in 1860, and called cocaine. It is an alkaloid which crystallises with difficulty, is but slightly soluble in water, but easily so in alcohol, and still more easily in ether. The discovery of the medicinal virtues of cocaine followed soon after the separation of the alkaloid. I remember that, when I was in Edinburgh in 1870, the eminent physician, Sir Robert Christison, spoke to me on the subject of the use of coca leaves. He was then upwards of eighty years of years, and he told me that he had gone up and down Arthur's Seat, with the use of coca, with a lightness and elasticity such as he had not experienced since he was a young man. He foretold that coca would attain the important position in the pharmacopœia, before long, which it now holds. It was in 1884 that the great discovery was made by Herr Koller, at Vienna, that cocaine produces local anæsthesia.

Export.—The great medicinal virtues of cocaine have since been ascertained, and a demand has arisen for the leaf which will increase. My latest Custom House returns from Peru are for the last quarter of 1890, when the export of coca leaves from the ports of Mollendo and Salaverry to England and Germany were 14,689 lbs., worth £642, and of cocaine from Callao 2,046 lbs., worth £372. If these returns may be quadrupled for the whole year, the quantity of coca was 58,756 lbs., worth £2,568, and of cocaine 8,184 lbs., worth £1,488.

Plants distributed by Kew.—For the cultivation of the coca plant in our Colonies and in India we are indebted to Kew Gardens, an institution to which this Empire, and, indeed, the whole civilised world, owes an immense debt of gratitude for its wise and indefatigable exertions in the distribution of plants. In 1869 coca plants were raised from seed at Kew, which came from the Department of Huanuco in Northern Peru. They belong to a distinct variety first described by Mr. D. Morris, the able Assistant Director of Kew, and named by him *Nova Granatense*. From this variety the plants are derived which are now growing in Jamaica, St. Lucia, Trinidad, and Ceylon. They were introduced into Jamaica and Ceylon in 1870. Experience derived from cultivation in our Colonies seems to indicate that the coca plant thrives best at low elevations, from the sea level to 3,000 feet; from the point of view of the largest yield of cocaine. But if the yield of crystallisable cocaine is considered, the plants grown at high altitudes are the richest. The Bolivian leaves yield 0·45 of cocaine, nearly all crystallisable. The largest yield is recorded of a plant at Darjiling, in India, growing at 900 feet above the sea, namely, 0·8 per cent., of which 0·45 was crystallisable. The next highest yield came from a plant at 100 feet above the sea in Jamaica, which gave 0·76 per cent., only 0·33, or less than half, being crystallisable; while Ceylon plants, at 2,300 feet elevation, yielded 0·6 per cent. of cocaine, the whole being crystallisable. At Buitenzorg, in Java, which is 820 feet above the sea, the yield was 0·39 per cent., of which 0·3 was crystallisable.

Tropsine.—I am indebted to Mr. Morris, of Kew, for the information that a new product has been obtained from the small coca leaves exported from Java, which is called *tropa cocaine* or *tropsine*, and has lately come into use. It is described as more reliable and deeper in its action than cocaine, and, unlike the latter, it acts as an anæsthetic on inflamed tissue.

Yield of Leaves.—Coca leaves are now exported from Ceylon, Jamaica, Mauritius, Trinidad, and Java, besides Peru; and the Government of India is now proposing to grow coca for its own needs. Of course the yield of alkaloids is the main consideration in the growth of coca leaves for exportation, while the best kinds for home consumption are those which best suit the tastes of consumers.

Deterioration and Price of Leaves.—The deterioration which the leaves suffer from long journeys, and from being kept, caused me to abandon the idea which I entertained many years ago, of promoting the importation of coca leaves for use by mountaineers and others in Europe. It now appears that there is a distinct loss of alkaloid in the leaves, caused during a long voyage. This circumstance has given rise to the manufacture of a crude alkaloid at Lima, containing 70 per cent. of pure crystallisable cocaine, which sells at 15s. per oz. The leaves fetched from 10d. to 1s. 6d. per lb. in London and at New York, but now the price is much lower. Last week a parcel of 8,500 lbs. was sold at 2d. per lb., bu they had been under water for several hours. It seems, therefore, very unlikely that it will be worth while to export the leaves from India or the Colonies. The production in South America is so enormous that Peru will always be able to meet the demands of the markets of Europe and of the United States with the crude alkaloid, such as is now manufactured at Lima. But it will, doubtless, be profitable, both in India and in the Colonies, to grow sufficient coca for the purpose of manufacturing cocaine and tropa-cocaine to meet all local demands.

Concluding remarks.—I trust, then, that the recognition of the virtues of the coca leaf will be, in the first place, beneficial to the Peruvians. It was the Peruvians who discovered some of those virtues many centuries ago; it is due solely to their industry and agricultural skill that coca was converted from a wild and useless to a cultivated and most valuable plant; and as to them belongs the honour, so to them should accrue the principal share of profit. Great benefit will be conferred upon an increasing number of people throughout the world by the use of this remarkable specific. Lastly, our own Colonies and British India will be able, through the action of Kew Gardens, to raise sufficient to supply the needs of their own populations. Thus we find, in the history of coca cultivation, one more instance of the benefits derived by the old World from the products that are peculiar to the New World; and one more example of the debt we owe to the Incas of Peru. If they had not, by the application of unrivalled skill and care, converted the coca and the potato plants from wild to cultivated products, we should probably never have known either the virtues of the one or the value, as a source of food supply, of the other. The gratitude of the peoples of the Old World is, therefore, due to the Incas of Peru, whose civilisation secured to us such inestimable benefits.

THE FIGHTING AT WANO, 23rd November, 1894.—The following account is condensed from the very able letter in the *Pioneer Mail*, 6th December, 1894, from one of the *Pioneer* correspondents. We only regret that want of space prevented its reproduction *verbatim*:—

The camp is surrounded by nullahs, which, on a dark night, enable a large body of men to advance close before being seen; I say "seen," as "nearing" has nothing to do with the present case, the enemy having grass shoes and a wonderful power of keeping silence and advancing stealthily, a habit only to be acquired after many years of raiding and robbing.

From our point of view the enemy's attack was perfection in every detail of organisation and discipline. No troops in the world could ever deliver a better night attack. Only those who have done night marches with troops know of the hundred and one mistakes which occur simply in keeping a battalion together, and only those who have shared in night attacks can realise the thousand and one difficulties which have to be successfully met in order to bring off a night attack and ensure the co-operation of different columns. Yet here we have illiterate men teaching Europeans the way a night attack should be planned and carried out. Of course the two cases are scarcely parallel, but still the greatest credit is due to the enemy for their splendid organisation and management; not a single detail being forgotten. Their tactics were much as follows. Firstly, to break up into three distinct bodies, the largest and main column to attack the left of our camp by a succession of sudden rushes or waves, the second column to advance on to the whole of our front in a single rush, as soon as we were well engaged on the left, and the third, or smallest party, to sweep through the rear guards and loot the camp while the other two did the fighting; at the same time, many were placed on the hills to the east of camp in order to occupy our right and rear. A fire was lit on the high hill to the east of the camp, when the enemy must have been fairly close, possibly to show the direction of our right, giving the enemy a point to march on, without which their columns would possibly have gone astray, for, owing to the darkness of the night, previous knowledge of the ground was of little use to either friend or foe.

It is one of the fanatic's fancies to see dawn before he dies, and in order to satisfy this the following plan was adopted, as had they waited to charge till dawn was apparent to them on the plain, it would have been too late. Men were posted on the high hill to the east of camp, and as soon as these could discern dawn they gave the signal by holding up two huge torches in the air and throwing them down suddenly. Almost instantaneously came the first charge. I must now return for a short time to describe the camp, piquets, etc.

The disposition was thus: the piquets No. 8½ –two N.C.O's and twelve men G Company 1-1 Goorkhas; No. 9—one N.C.O. and six men ditto; No. 10—ditto Bogry piquet—one N.C.O. and three men D Company; No. 11—one N.C.O. and six men G Company. Left support to 8½ and 9—one N.C.O. and twenty-six men D Company of Goorkhas; right support to 10, Bogry, and 11—one havildar and seventeen men D Company of Goorkhas. Besides the above the Goorkhas had in their quarter-guard one havildar and nine men; Regimental Police Guard ditto; Field Hospital front—one N.C.O. and six ditto; rear one N.C.O. and six men. Their alarm posts were as follows:—H Company in front of Field Hospital; C Company in front of regimental camp; F Company of their 2nd Battation on left of regimental camp, G Company rear of their camp, B and E Companies in reserve in centre of their lines, H Company with Captain Powell in the fort to N.E. of 3rd Sikh Camp.

The dispositions of the 3rd Sikhs were as follows:—On left and right front twenty rifles in each behind breastworks; quarter-guard in centre of front, being connected with right by another breastwork for twenty rifles. The right flank was protected by a stone wall some 60 yards in length and a shelter trench of similar length, each to be held by a full company. About 150 yards to the front of this flank was a 4-feet high sungar held by forty rifles, who acted as supports to the piquets, and *en même temps* afforded a flanking fire against any attack on this side. The rear was defended by a full company behind a shelter trench. Piquets Nos. 1, 2, 3, 4, 5, and 6 were occupied by the 3rd Sikhs, the remainder of the battalion being held in reserve in a central and suitable situation. The squadron of the 1st P.C. were distributed, about forty men, along a breastwork in front, and, the rear being the weaker, it was manned by about sixty sowars, the syces being left by the horses. The 20th P.I. occupied piquets Nos. 7, 8, and 12, and besides occupying the walls in front and rear of the regimental lines, A and B companies were held in reserve, and these two were the ones sent to the assistance of the Goorkhas when the attack had begun. This regiment furnished a guard of two N.C.O's and sixty-four rifles over the Commissioner's camp; piquets Nos. 7 and 8 took eighty-two rifles, including a support, and Nos. 12 one N.C.O. and twelve, with a support of two N.C.O's and twenty, about 200 yards in rear. E Company guarded the wall in front of the G.O.C's camp.

No. 2 Company Bengal Sappers and Miners had forty in rear of the Battery Camp, and fifty rifles as escort to the guns. The Commissariat Godown had a guard of two N.C.O's and twelve from the 20th P.I.

The weakest point in the whole of the camp was undoubtedly the Commissioner's camp, though there is a mud wall and tower at one corner, which would have been a safe harbour of refuge.

At four o'clock the whole camp was roused, and officers saw that the men sat up fully accoutred and ready. The enemy delayed their attack until it was too late to secure their retreat under cover of darkness; this was their only mistake, one for which they paid dearly when overtaken by the cavalry and pursuing force. The reason for the lateness of their attack has already been given before, viz., the fanatics desired to see dawn before dying. This point should be borne in mind in future when officers are threatened by an attack of fanatics. Their attacking across an open plain of 600 yards could scarcely be called a mistake, as they came on the very flank on which the consensus of opinion indicated they would not come. Their line of reteat was not well chosen, for had they gone by the road to Karb Kot and branched off by the main route to Khaisara *via* the Tiarza Kotal, they would have been protected all the way by nullahs, hills, and very difficult ground for infantry. From the sketch it will be seen the line the attack took. At 5.30 a.m. we all were awakened by noises it would be impossible to describe. If any one can imagine the following all combined, a fair impression of the uproar will be obtained. We all awoke hearing ghastly shrieks resembling the jackal, a fusillade from the enemy it would be hard to beat for intensity at first, shouts of

"Allah," "Allah," beating of toms-toms, the shrill whistle of the infantry officers; add to these the hubbub of about 3,000 men and followers falling in, and the cries of about 3,000 fanatics——!! The shriek of a Waziri advancing to attack resembles most curiously the cry of a jackal. The first rush evidently passed between Nos. 9 and 10 piquets, supported by a few coming up the nullah from the Bogry piquet direction. Half No. 10 piquet were killed, the remainder escaped by hiding. One Goorkha, by placing his ear to the ground, distinctly heard the hushed sound of grass shoes treading the earth, and was sent back to tell the support, but so sudden was the enemy's rush, and so quickly made, that the man never reached the support; being overtaken *en route*. This reminds one of a practice it might be sound to adopt at certain times, viz., if the distant approach of a large body of men is to be ascertained, and the country be fairly open, place a drum on the ground and put your ear to the skin. It is said a large body, six miles distant, can be heard thus.

In three minutes from the first signal of the enemy's approach, the first rush struck the left flank of the camp, being composed of about 800 Ghazis, some few of whom, passing through the tents of the men, the main street, regimental hospital and transport lines, wheeled outwards, some by the front and some by the rear of camp. Out of this rush forty bodies of Mahsuds were found within the camp of the Goorkhas. The first rush undoubtedly took the Goorkhas by surprise, and they had to fight their way to their posts, many being killed or wounded in the attempt. Major Robinson, Commanding the Goorkhas, was met by many Ghazis as he came out of his tent, and emptied his revolver before he got to his men, each shot being fired at within five paces. The second wave of the first rush—for it came so soon after the first rush that it could scarcely be called a second rush—was as gallantly pushed home as its predecessor, and the companies of the Goorkhas in reserve were just forming up as it came upon them; twenty men had not fallen in when they were struck on the left flank, and forming a rallying square under Major Robinson, fought back to back and hand to hand for many minutes. It was in this *melée* that the Jamadar Adjutant, Khark Sing Nagarkoti, was killed by a knife stab, and Captain Lang and Lieutenant Angelo were wounded, being shot, and several others were killed or wounded.

The steadiness of the men and the excellent examples of their British officers undoubtedly prevented the Ghazis of the second phase of the first rush from passing down the centre street of the brigade. Some thirty, however, did get through and came down, hacking their way through mules and tents, and one of the most weird sights of the night was to see about thirty Ghazis coming down the centre street dancing, yelling and waving swords, then suddenly to stop about fifteen paces off and discharge all their loaded guns towards the cavalry horses, after which they seemed to have broken up into ones and twos simply to cut loose horses and ponies standing in the commissariat or hospital or cavalry lines. Lieutenant Ballantyne, 1st P.C., did very well just at this time, for the cavalry syces having bolted, he was ordered to go to the horse lines and try and restore order, and catch the horses which had been cut loose. He met some Ghazis in the lines, and shot one of them dead, and thus, undoubtedly, saved many cavalry horses from being cut loose. After the first attack there was a kind of a lull for some minutes, and as soon as it became evident that the left was the flank chiefly threatened, General Turner ordered up in support of the Goorkhas the two Reserve Companies of the 20th Punjab Infantry, under Colonel Meiklejohn; these did right well, for both companies, advancing in extended order with fixed bayonets across the whole of the camp from their lines up to the left flank, cleared it of all Ghazis and thieves without firing a shot in doing so; they killed several *en route*, and it was in this advance that Lieutenant Thompson was hit in the arm with a bullet. Considering that the now familiar "ping" of passing bullets was rending the air in all directions, this advance in silence of the two companies of the 20th deserves special mention. They were shortly followed by one company of that

fine regiment the 3rd Sikhs, all three being formed in line with the Goorkhas when the enemy's second rush was delivered, but owing to the gallant stand made by No. 9 piquet under a Goorkha native officer, who was killed, the enemy were split up into two distinct bodies, some few coming in by the rear of the hospital, Commissariat and 1st Punjab Infantry, and others going down the nullah trying to force an entrance through the rear guards. Of those who came across the open towards the left flank none were ever closer than fifty yards, as their spirit was broken by the withering fire from the companies in line, so they then contented themselves with keeping up a desultory fire and beating of drums.

The men who succeeded in coming in from the rear of the Goorkhas did considerable damage to the Goorkha mules and Transport drivers. Finally, passing on to the hospital they cut several tents to pieces, wrecked the medical officers' mess, and looted many officers' ponies and belongings.

During all the time that the enemy were attacking the left, our front was being threatened by large crowds of the enemy, but thanks to the excellent effect of the star shell, which enabled well-directed volleys to be poured in, none of the Ghazis actually came up to the front line of bayonets. The star shells, fired over left flank were invaluable, for as soon as the ground was lit up remarks were heard saying, "What an excellent arrangement," etc. The good moral effect in one's own troops of star shell is admitted by all present.

There is one general regret all through the camp that the enemy gave no chance to the 3rd Sikhs, R.A., and R.E., for showing the excellent *matériel* these corps are composed of, and because the Goorkhas had to bear the main brunt of the fighting, it must not be thought under any circumstances that the other corps could have done anything more, they simply had not the chance owing to their position on the right, but by their steadiness all through and their excellent fire discipline, they proved that if they had had the luck they would have done as well as those actually engaged. It must be remembered that the night was pitch dark and the camp was threatened nearly equally on all sides, hence it was impossible to withdraw more troops than were actually sent from one quarter to reinforce another. Shortly after the enemy's second rush dawn began to be apparent, and orders for the pursuit were issued.

The General Officer Commanding and his Staff Officers inspired confidence in all ranks by their coolness; messages given in a natural tone of voice; no hurry or excitement visible amongst any of the message bearers; these are qualities so desirable amongst Staff Officers in an action, specially in a very severe fight at night.

THE PURSUIT.

The fighting lasted about forty minutes. As soon as it was sufficiently light the pursuit was organised. Sixty sabres were all that could start, as the horses of the others had been cut loose and were not caught in time. This handful of cavalry, well led by their commander, soon came up with the retreating enemy, and then followed a succession of charges, first on the nearest body of the enemy, who were soon scattered, then on to the next and the next, then again on to those that had collected again in rear, and so on for some time, until no body of men more than twenty or thirty were allowed to get together. The lance proved its superiority over the sword in a pursuit. Each of the three British officers actually killed four men each, and the whole party accounted for over fifty killed and many wounded. The cavalry pursued until the ground became too mountainous for their work. As it was the country traversed was very rough and stony, and much intersected by nullahs, and had the enemy used them to make firm stands, much loss to the plucky handful of horsemen must have resulted.

Seldom has cavalry had such a chance of late, and the 1st Punjab Cavalry were lucky in being able to prove of what excellent *matériel* the regiment is composed, and how thoroughly the officers and men, from their residence on the

frontier, know and understand the way to deal with these border hillmen. The cavalry were soon followed by all the 3rd Sikhs except 150 men, four companies 20th Punjab Infantry, Captain Powell's company of Goorkhas from the fort, and Captain Hunter Weston's company of Sappers, who did escort to four guns of No. 3 Peshawar Mountain Battery; the whole under the command of Colonel Meiklejohn, 20th Punjab Infantry. The guns unfortunately had not a chance of firing, as no large groups of men were ever visible, and it never does to waste shells over twos and threes of the enemy. The infantry accounted for another thirty killed and many wounded. The total losses on both sides are: *British*, one officer and forty-four men and followers killed, six British officers and sixty-nine men and followers wounded. *Mahsuds*, over 300 killed, including eleven leaders, and some 300 wounded, including two leaders, of whom latest reports say over 150 have already died.

The enemy had a good idea of the camp and how everything was situated, for some of the looters went straight for the treasure chest of the Commissariat Agent, who foolishly kept his money in his tent, and this money the enemy divided amongst themselves the next day in Khaisara. So ends an account compiled from all available authentic sources.

There are several lessons to be learnt from this night fight, and a short *résumé* to finish up with may prove of interest.

First.—No matter what the general idea may be of the probable line of attack by the enemy, every corps should be prepared just the same as though it was certain the enemy had selected its very camp for assault. The strong breastworks erected by the 3rd Sikhs undoubtedly had some moral effect on the enemy when deciding which point to attack. If the Goorkhas had had time to erect similar works on their left flank they would probably not have lost so heavily, though they possibly were selected as the regiment to attack owing to the Waziris having no idea of the fighting powers of a Goorkha, and also because of their all being Hindus.

Secondly.—If a night attack is possible a kind of "keep" or enclosed space should be established by every regiment for its followers, who should assemble in this "keep" and be kept there by a guard of men. Nothing is more distracting than to see dozens and dozens of kahars, muleteers, and other followers flying down a street towards one's ownself. In the dark it is so hard to distinguish friend from foe. To tell them to stay by their mules or horses or tents is *useless*; they are all unarmed and usually not of a fighting class; they get terrified, and no orders in the world will prevent them from stampeding, unless put into a secure place and kept there.

Thirdly.—Regimental officers should from the beginning of a campaign try and learn everything they can of the peculiar tactics and customs of the enemy they may meet, and of the best ways of defeating the same. This applies naturally to the junior ranks who are not acquainted with the tribes on our frontier.

Fourthly.—Volley firing at night by the aid of star shell should be practised much more, and the number of star shell per gun for Mountain Artillery should be increased from two to six per gun.

Fifthly.—Any attack by the enemy at night should be immediately followed by a counter attack and most vigorous pursuit, as was done at Wano, for nothing is less expected by the enemy and nothing demoralises them so much.

The "Training of Volunteer Infantry," by Colonel C. G. A. Mayhew. Since the lecture above-mentioned was first printed, the Regulations for the Volunteer Force, 1894, have been issued, and Colonel Mayhew has kindly supplied us with the following notes in order to bring his paper up to date:—

MUSKETRY INSTRUCTION (TABLE A), RECRUITS' COURSE. (APP. VIII.)

The following preliminary drills will be carried out before a recruit proceeds to target practice. (Chap. III., Musk. Reg.) :—

*Four lessons in instruction in care of arms.
*Two lessons in theoretical principals when practicable.
*Eight firing exercise drills.
*Four aiming drills, consisting of such portions of the Section of Aiming Drill Musketry Reg. as the C.O. may direct.
*Instruction in judging-distance drill to be given when practicable.
*Each of these lessons and drills to last about half-an-hour.

Miniature cartridge practice or blank firing ... { Five rounds standing. ,, ,, kneeling. ,, ,, lying down.

At the firing exercise drills, at the last four drills great attention must be paid to instruction in volley firing.

[N.B.—In order to ensure that every recruit performs the above course of preliminary drills, it would be necessary to provide for irregularity of attendance, as shown in the "Diary of Parades."]

Paras. 458 F, G, H, I, K, L, give the qualifications for the Volunteer Long Service Medal, which Her Majesty has been graciously pleased to confer on Volunteers after completing twenty years' service.

ERRATA.—Trained Volunteers' "Diary of Parades." Musketry and judging distance drills should be bracketed. The word "principally" should be inserted before "devolve the duty," p. 4; "63" rounds for "60," p. 6.

C. G. A. MAYHEW.

Derby, *15th December, 1894.*

BELGIUM.—Reorganisation of the Army. The Minister of War, General Brassine, is about to lay before the Chambers a scheme for the complete reorganisation of the Belgian Army.

The basis of the scheme is obligatory service for all; admitting, however, exchanges between men on the active list with those in the reserve. Service with the colours will be materially reduced and the annual contingent correspondingly increased. Officers and N.C.O's to be recruited from the one-year volunteers. Everyone not serving in the army to pay an annual tax, the amount of which will be hereafter determined.

The field army will consist of four divisions, each of three brigades, with a battalion of rifles, twelve batteries, a cavalry regiment, and all necessary trains. Its total strength will be 100,000 men. and 80,000 additional fortresses troops.

FRANCE.—The following summary of recent progress in the land defences of France has been prepared by Major T. Ryder Main, R.E., Instructor in Field Works, S.M E., Chatham, from the *Nouveau Manuel de Fortification Permanente,* and kindly placed at our disposal by the Editor R.E. Corps Journal :—

We would call special attention to the importance attributed to the power of high explosive bursters, and would add that this view is fully concurred in in Germany and Russia.

FORTIFICATION SINCE THE INTRODUCTION OF HIGH-EXPLOSIVE SHELLS.

(I.)—FORTIFICATIONS PRIOR TO 1885.

Shape of the Forts.—The shape of the detached forts is very variable. The commonest shape is a pentagon, with two faces, two flanks, and a gorge; or a trapeze, with only one face. The front and flanks follow the polygonal system; the gorge is often bastioned. The flanking of the ditches is usually by caponiers at the angles.

FRENCH FORTS PRIOR TO 1885.

SECTION THROUGH FRONT OF CAVALIER FORT.

SECTION THROUGH PARADOS FORT.

J. J. Kelliher & Co. Litho. London

Forts with Tiers of Firing Lines and Forts with a Single Firing Line.—Looking at the number of firing lines and their arrangement, one can class the forts under three distinct headings:—1. Cavalier forts. 2. Parados forts, or forts with a mass in the centre. 3. Forts with a single firing line (*à crête unique*), or Flat forts.

Cavalier Forts (1).—These are those constructed between 1874 and 1877, in which, like those constructed before 1870, a double firing line was arranged, that for the artillery forming a cavalier in the interior 40 to 50 feet high, containing the casemates and stores underneath it (X), and that for the light pieces and infantry forming an enveloping parapet (Y) of only 13 to 16 feet high (see *plate*).

Parados Forts.—In these forts, constructed between 1877 and 1884, the artillery is placed on a low rampart (A) which has no arrangement for infantry. It was seen that the high relief of the cavaliers was of no use to the artillery in the distant fight, and that it was just as well on a low parapet, provided it was in communication with good observatories either inside or outside the fort, to correct its fire. In order to cover the casemates and to protect the gorge, a huge central parados (B) is formed, which has on it an infantry parapet and a few light guns for the close attack. Furthermore, in order to obtain a grazing fire in the close attack, an attempt is always made to provide for infantry on a secondary lower parapet (C), or on any unused portions of the artillery rampart. This type of fort, as well as the cavalier type, have considerable disadvantages, as we shall presently show; but the double advantage of economy and rapidity of construction caused the exclusive employment from 1877 to 1884 of the type with the central parados because (*a*) the length of crest line is at a minimum, the fighting parapet (? for the guns—T. R. M.) being an enveloping one instead of being enveloped, and (*b*) that one can construct simultaneously the casemates and traverses for the artillery when they are no longer one over the other.

Flat Forts, or Forts with a Single Firing Line.—These forts, some of which it was proposed to construct at Belfort, were designed in 1880 to avoid the difficulties inherent in having a large mass in rear of the low parapet. In them there is only one crest for the heavy artillery, infantry, and light guns. The casemates and magazines being arranged under the parapet, the idea of two floors had to be given up for fear of giving two much relief to the parapet, and so creating dead ground in front of the counterscarp.

By using the arrangement adopted in France prior to 1870, and in Germany in most of her new forts, it is possible to get well-sheltered casemates. This arrangement consists in making casemates to face the ditch of the gorge, but it gives but indifferent casemates with no parade ground in front, unless one makes use of the ditch as such by making outlets on the face, and then one is open to surprises. Besides, these underground casemates are unhealthy.

(II.)—Fortifications since 1885.

Artillery and Fortification in 1885.

Progress made by the Artillery up to 1885.—During the period of building the fortifications which have just been described, artillery was making great progress;—in the place of direct fire, which was its characteristic employment from 1860 to 1874, and gave rise to high parapets so that it could sweep the country at a distance, the period from 1875 to 1885 was marked by the development and perfecting of high-angle fire. The progress in effect was this:—

(*a*) *Increase of accuracy*, so that one could now fire with small calibre guns with as much accuracy as with heavy ones up to 5,000 or 6,000 yards.

(*b*) *The manufacture of powerful and light pieces* which allow of accurate high-angle fire up to 3,000 yards.

(*c*) *The lengthening of the shells* beyond three calibres, increasing the power of penetration, and allowing of a large bursting charge.

(1) Most of the large forts around Paris are of this type—T. R. M.

(*d*) *The general employment of shrapnel shell against the "personnel,"* and the perfecting of time fuses so as to make these shells very murderous, and diminishing the protective power of parapets.

(*e*) *The improvement of laying arrangements,* especially those for indirect fire, rendering useless the employment of high ramparts.

Effect on Fortifications.—The effect of these large improvements has been to place the fortifications constructed between 1875 and 1885 in a state of undeniable inferiority. Still, up to this point the existing arrangements could ensure, for a time, a certain protection to *personnel* and *matériel* whilst fighting, and every security when off duty. But the discovery towards the end of this period that it is possible to use high explosives as the bursting charge of the long shells (*obus-torpilles*) has caused the greatest trouble in the minds of Military Engineers (*vint jeter le trouble le plus profond dans l'esprit des ingénieurs militaires*). These new projectiles challenge even the value of those means of protection on which one had counted, and threaten (if not to annihilate), to seriously depreciate them.

It is evident that the artillery of the defence has also profited by these improvements, but not to the same extent as that of the attack. The use of high-angle fire and the lengthening of the shells has given an incontestable superiority to the latter.

The principal defects of the fortifications constructed between 1875 and 1885 may be tabulated as follows :—

1. The works offer too conspicuous a target.

2. They were constructed to resist direct fire, and would suffer much from high-angle fire.

3. They enclose a space too confined and too dangerous for men and materials.

4. The long intervals which exist between the forts are a cause of weakness.

It is important to dwell a short time on each of these defects, and to consider its value as well as the results it is likely to bring about, while still keeping within the limits of a cursory summary. We cannot enter just here into the study of the means of improvement proposed, because this study is scarcely entered upon before one has to recognize the necessity for still more radical reforms required by the power of the high explosive shells (*obus-torpilles*).

1. *The Too Conspicuous Target offered by the Works.*—The appearance of our forts, as seen from the outside, has for a long time struck a great number of soldiers. These works, planted on elevated sites, offer a grand target, and are plainly visible from a distance, on which every shot of the attack must tell. In addition, the numerous traverses, standing up as they do above the crests, plainly point out the positions of the guns of the defence. This drawback is particularly marked when the traverses stand up against the sky. The employment of a massive central traverse, which forms in rear of the artillery rampart a dark plain, as a background to the traverses, hides them to a certain extent ; but this elevated mass is itself very discernible, and has other drawbacks, as we know (*i.e.*, the back splinters from high explosive shells). If one falls back on a fort with only one crest (flat fort), the general relief is lowered, but the traverses once more stand out against the sky.

It is evident that these objections are sound, and that the making plantations on the forts (as at Paris) was an insufficient remedy. By 1885 the advantages of relief and of traverses no longer appeared to counterbalance the assistance which these arrangements gave to the attack.

2. *The Effect of High-angle Fire on the Forts.*—The accuracy and power of high-angle fire are such that the protection offered by the parapets, traverses and parados is entirely insufficient if one wishes to avoid serious losses. The pieces, even if well covered, could be rapidly dismounted if the enemy managed to range on them. Since high reliefs and traverses are forbidden, one cannot get over the difficulty by means of covering masses. The solution can only be found in the use

of batteries for curved fire, either in armoured batteries or cupolas. But we shall see directly that the accumulation of material in a space so confined as a fort is a source of weakness, and that other measures than these are necessary. A further consequence of the perfecting of curved fire, and of the increasing of the bursting charge of shells, shows itself in the ease with which it is possible to form breaches, and to demolish masonry in general. Rifled howitzers and mortars can in a short time destroy and overthrow the best defiladed walls, and arches which are not covered with more than 9 feet of earth are also very liable to destruction; and to dismount the pieces and to search out the terrepleins and ramparts it is no longer necessary to firstly destroy the parapets, or to drag about such a cumbersome mass of material as was formerly the case.

As a fact, even before 1885 the Germans saw the importance which should be given to curved fire, and had increased the proportions of short guns and mortars in their seige train, and had made some pieces specially light and powerful for the sudden assault (*l'attaque brusquee*) of our *forts d'arrêt*.

3. *Too much Crowding of the Defence.*—The preceding considerations show how the collecting together of so much *personnel* and *matériel* in a space so confined as a fort, whose site and form is easily ranged on, would be dangerous. The fate of all who are shut up in a work is intimately bound up with that of the artillery which it contains, and it is certain that if this latter was rendered powerless the defence would be seriously weakened. This difficulty can only be got over by an entirely new defensive organisation, banishing from the fort all fixed artillery not covered by armour, and giving more use for artillery in the intervals. We shall have occasion to constantly recur to this important question.

4. *Reason of Weakness of Long Intervals.*—The defending of long intervals between attacked forts, confided to redoubt-batteries or mobile troops, requires considerable *personnel* and *matériel*. The defenders, to do so, would be obliged to strip those sections which were not attacked, and to carry out, at the last, movements both slow and dangerous. Some German soldiers, great authorities on these points, infer that whilst such movements were being effected, or before they were executed, an attack *de vive force*, carried out simply with field artillery and some light siege pieces, ought to have a chance of success; and that during the siege, even if the forts are more than 3 000 yards apart, unless the garrison and *matériel* were very numerous, an attack of this sort on a point diametrically opposite to the regular attack, ought also to succeed.

These reflections certainly take an exaggerated view, for if the defence is vigilant and active, such an attack could not be undertaken without serious danger. Nevertheless, it is incontestable that long intervals are a cause of weakness which cannot be compensated for by an increase of the *personnel* of the defence, and we shall shortly see that it has been necessary to take account of this in the proposed improvements which have been brought forward.

Artillery and Fortification since 1885.

Progress of Artillery since 1885.—Up to this time powder alone was employed for the bursting charge of shells; the only high explosives known were unstable, and given to premature explosion. Many experiments were made to get a more satisfactory result, and eventually the Germans adopted gun-cotton, and the French mélinite, the latter having apparently a slightly greater strength than the former, and possessing all the qualities necessary to good conservation and for security in handling. With the object, too, of increasing the size of the burster, the projectile was lengthened sometimes up to six calibres, and for the same reasons the walls of the shells were made very thin. These projectiles have received the name of "*obus-torpilles*," or sometimes "*obus-mines*."

As a further progress in artillery, there is the introduction of quick-firing guns, and the invention of smokeless powder; which latter makes it difficult to fix the position of the gun emplacements, but facilitates fire from casemates.

Experiments carried out in Germany.—Numerous experiments have been carried out with a view to determining the probable effect of high-explosive shells on fortifications. They were notably carried out in Germany, at Cosel and Cumersdorf, and, notwithstanding that the results were kept secret, we know the following :—

A single 6-inch shell, charged with 50 lbs. of gun-cotton, blew down an escarp wall with counterarches (*voûtes en décharge*); a single shell from a rifled 8½-inch mortar, charged with 42 lbs. of cotton, pierced arches of good masonry 3 feet thick, covered with a bed of concrete 2½ feet thick, and of earth 3 to 4½ feet, that is to say, arches similar to those of our shelter casemates, powder magazines, etc. These mortar shells, too, with delay-action fuzes, penetrated 13 feet into sandy loam, and made a crater of 5 cubic yards capacity.

When there was a cushion of earth 3 feet thick between the point of explosion and the arches, these latter were not appreciably affected.

Experiments carried out in France.—In the experiments carried out at Fort Malmaison in 1886 with *obus-torpilles* charged with mélinite, some results were arrived at, of which the following alone were divulged :—

The most curious result, and which at once strikes one, is the effect of the blast produced by the explosion, which can be felt at a great distance. At a short distance the blast alone does serious damage. Thus a shell falling in the narrow yard of a fort, by its explosion, threw the façade wall against the back partitions; falling close to a detached wall it broke it up or threw it down for a considerable length. The splinters were hurled with so much force that they went through and cut to pieces the double-headed rails acting as a blindage to the openings.

According to General Brialmont, a 9-inch shell, charged with 70 lbs. of mélinite, having fallen fair on to a caponier covered with 10 feet of earth, made a breach in it about 8 feet in diameter. A similar shell bursting behind an escarp or counterscarp with counterarches made a breach 40 to 50 feet long.

In a general way the effects are always disastrous whenever the shells act, by pushing masonry into open space. Those which come down with a high angle of descent behind revetment walls have still greater effect, especially if they burst close to the wall after considerable penetration. The earth acts as tamping, so that in many cases earth over masonry is more hurtful than useful.

The caponiers, which, from their construction, are specially exposed to the effects of shaking, will suffer most from projectiles falling in their vicinity; they will be surely but rapidly ruined by the shells which reach them.

The effects produced by high-angle fire on arches are so much the more considerable, as the shell bursts close to the masonry. The damage is much diminished if there is a cushion of 3 feet of earth between the point of burst and top of the arch. But the penetration of an 8½-inch shell with delay fuse is such that existing earth coverings (not considering their tamping power, which renders them harmful) would soon be cleared away.

Let us remember, also, the very formidable asphyxiating properties of mélinite.

At the experiments made at Bourges in 1886-7 it was concluded that ordinary masonry, whatever its thickness, was soon scattered.

Amongst the shelters tried and constructed with different materials, the only ones that gave satisfactory results were those of cement concrete.

It was recognized—

1. That a thickness of 8 feet of cement concrete is more than sufficient against mélinite shells, and this thickness has been adopted in order to provide against a possible increase in the power of artillery.

2. That a cushion of sand or rockwork may be usefully employed, either to localise the effect of the explosions and deaden their shaking effect, or to diminish the penetration of the projectiles.

To guard against those portions of a mass of concrete below the natural soil which are exposed to the action of projectiles being laid bare and undermined, they should be directed downwards at the extremities till they are 8, 10, or even 16 feet below the surface. A mass of sand, or, for want of that, of rockwork, placed at the base of a mass of concrete, will act in the place of guard walls against these effects of undermining.

(*To be continued.*)

JAPAN.—From the letters of the *Times* special correspondent we extract the following notice on the Japanese troops and their transport service. To our mind they furnish more really useful information as to the spirit of the Japanese soldiers than anything else which has yet come to our knowledge. The writer evidently appreciates the truth that the efficiency of an army is the sum of the efficiencies of its units, and not its mere numerical strength on paper :—

The accommodation for troops is not unlike the usual steerage-passenger arrangement on emigrant ships. The Japanese are justly celebrated for their skill as carpenters, and the work is neat, light, substantial, and economical of space. This matter is greatly simplified by the habits of the people in regard to eating, washing, etc. ; to squat on the floor is only their custom and entails no hardship ; each man carries in his bundle a rice bowl, chopsticks, and water-bottle, and that is all he would ever think of having—he wants no tables, chairs, plates, etc. They all wash regularly at the common tap or well in their native villages, and do the same on the ship naturally. Oriental races are not accustomed to feather beds, and so to sleep on a grass mat on the deck comes as a matter of course ; all they need is to have a raised floor, so that they can leave their shoes or sandals below and keep the "home" quite clean. Thus, without bedsteads or bunks, without chairs or tables, there is more room for 1,000 Japanese on a 1,000-ton ship than Western people might expect. Of course, each soldier has his kit with him, and each transport coolie a small bundle of personal belongings, but these are next to nothing in the matter of space. The soldier's kit, after careful investigation and experiment, has been fixed at about the same weight as the European average—if anything a trifle smaller ; it consists of a spare pair of leather boots, European pattern (new) ; four new pairs of straw sandals, in case the boots are found unsuitable—for though men after three years of training under the Conscription Laws get on all right in boots, there are now many in the field who had finished their three years and returned to private life and native foot-gear. They also have a heavy overcoat with hood, rice-bowl and chopsticks, water-bottle, bag to carry four days' compressed rice, pocket filter, and change of woollen under-clothing. All above the rank of private carry field-glasses. Their magazine rifle is the invention of a Japanese named Murata, now a member of the Upper House. Their sword-bayonets and the officers' swords have in many cases been refitted with old blades by celebrated makers at the soldier's own expense, for the superiority of the ancient Japanese swords is well-known. The uniform is, in most cases, a thick dark-blue serge. Most of the men provide themselves with thick woollen gloves. In the rank and file all the caps are of German pattern.

The coolies also have a sort of uniform, a thick wadded coat of light blue cotton, very similar to the ordinary coolie's winter kimono, with close-fitting breeches, and mostly bare feet or open straw sandals. They also have a change of underwear, food-bag, etc., like the soldiers.

It should be stated that every item of army expenditure is purely Japanese ; even the brass figures (English) on the soldiers' collars, denoting the regiments, are not from Birmingham, but from Osaka. There have been great numbers of letters sent to the War Office by European firms tendering loans or supplies of various kinds, but these only show what a great deal Europeans have to learn

about the Japanese Army. Not a single cent need, or will be spent outside of Japan. One Shanghai firm offered to supply unlimited cartridges at a high price per million—probably a price that had been already refused by China; but Japan has already in stock more than ever she can use in this war.

* * *

The Japanese soldiers are dressed, drilled, and manœuvred on strict German lines, though their dark uniforms, heavy coats, and features make them more nearly resemble Russians. On the other hand, they are short and thick-set, with round shoulders and crooked legs. There is not a trace of the East about their appearance, except when they take off their "ammunition boots" and put on sandals. And they are not simple, unsophisticated "children of a fairy paradise," as they have been described. Their practical modern knowledge and education would surprise Thomas Atkins. They talk quite capably about the campaigns of Napoleon, and especially the march to Moscow, as it bears on their projected march to Pekin. Some of them astonished me by casual references to Greeks, Spartans, Thermopylæ, and so on. This may not be believed; I enclose the name and address of one such, and that is all I can do. One of the privates of the 18th Regiment came to me, very much interested in various matters, and showed me his sword-bayonet; the blade had been replaced by some ancient weapon with a history and a beautiful temper. He knew all about the bronze *gladius* of the Romans, and discussed at some length from a technical point of view the merits of its shape and weight as compared with the one he had. How many British soldiers could do the same? Or how few British readers would have believed this of the Japanese?

* * *

All these questions are discussed ably, not alone by statesmen, but by the masses in Japan. I see the transport coolies keeping diaries on the ship and making copious notes in small pocket-books when anything occurs. One afternoon, a sergeant was explaining how the Chinese at Ping-Yang tried cavalry charges against solid bodies of infantry, yet made really no use of their machine guns, whereas at Waterloo the French used artillery and cavalry combined, and yet failed; and when this had been talked over out came the note-books in a very amusing manner. The Japanese seem to assimilate a wonderful amount of general information, often contemptuously set down as merely superficial, but the thoroughness and genuineness of their present undertaking show that their progress has been greater, quicker, and more real than foreigners comprehend."

RUSSIA.—According to the *Revue Militaire de l'Etranger*, the dislocation of the newly-formed 19th Corps is as follows:—

Headquarters, Brest Litowski.
2nd Division, Brest Litowski.
Artillery, Biëla.
38th Division, Kobrin.
Artillery, Proujany.
7th Cavalry Division, Kovel.

The same authority also announces the appointment of a Commander-in-Chief for the whole of the Cavalry in the Warsaw Circomscription, with staff as under:—

One Chief of the Staff.
Two Aides-de-Camp
One Staff Officer for special duties.
One Veterinary Surgeon.
One Assistant Surgeon (Feldseker).
Eight Clerks and one Orderly.

The subjoined list of the troops at this officer's disposal will enable the importance of this appointment to be better appreciated :—

1. The 3rd Brigade of the 2nd Division Guard Cavalry at Warsaw.
2. ,, 4th Division (6th Corps) at Biélostok.
3. ,, 5th ,, (5th Corps) at Vlotslavsk.
4. ,, 6th ,, (15th Corps) at Warsaw.
5. ,, 7th ,, (19th Corps) at Kovel.
6. ,, 14th ,, (14th Corps) at Kiéltsy.
7. ,, 13th ,, (Independent) at Warsaw.
8. ,, 15th ,, (Independent) at Plotsk.
9. ,, 1st ,, Don Cossacks at Zamostié.

In all 8½ Divisions, numbering 204 squadrons.

A NEW SHIP CANAL.—From the *Mittheilungen über Gegenstände des Artillerie und Genie Wesens* we condense the following notes of a project to unite the Baltic and Black Seas by a canal, 27 feet in depth, 213 feet in width at the surface and 114 feet at bottom. The project was initiated in 1891 by the French engineers Brière de Lisle and Defosse, and submitted by them to the French Foreign Office and to the French Consulate at Moscow. In 1892 a society was formed in Paris to proceed with the detailed surveys ; these surveys have now been completed, and from them the following statements are derived. The canal is to run from Riga, and following the course of the Dwina, Beresina, and Dnieper, to end at Cherson ; only the connection between the two former will have to be excavated ; the depth in the remaining portion can be obtained by dredging.

The total length is about 1,000 miles. The depression of the Pripijat Morass enables the canal to be executed without locks, and the nature of the soil nowhere opposes considerable difficulty to excavation.

Harbours are projected at Cherson, Aleschki, Berislawi, Nikopol, Alexandrowsk, Jekaterinoslaw, Novo Georgiewsk, Kieff, Bobruisk, Borrisow, Lepel, Dünaburg, Jakobstadt, Riga, and the towns of Pultawa, Zytomir, Oster, Ischernigow, and Disna are to be brought into communication with the canal by improving the navigation of existing rivers.

The canal to be lighted throughout with electricity ; and, at a maximum speed of 6 knots, time of transit to be about six days. Estimated cost, £20,000,000. Duration of construction, five years.

The company asks for a 4½ per cent. guarantee from the Government. The attitude of the Russian Government to this project is not known.

FOREIGN PERIODICALS.

NAVAL.

AUSTRIA-HUNGARY.—*Mittheilungen aus dem Gebiete des Seewesens.*—No. 1. Pola and Vienna : January, 1895.—"On Speed and Manœuvring Capacity." "The Naval Operations in Chinese Waters, including the Battle off the Yalu." "The Electric Signal-telegraph, system Pebal-Schascht, for use in ships" (with plates). "Translation of Lieutenant Calthorpe's Naval Prize Essay" (*continued*). "Gibraltar as a base for Naval Operations." "Budget for the Austro-Hungarian Navy for 1895." "The Budget proposals for the Dutch Navy for 1895." "Naval Notes : France, England, and Russia." "Notices of Books."

FRANCE.—*Revue Maritime et Coloniale.* Paris : December, 1894.—Has not been published up to time of going to press.

Le Yacht.—Paris: 1st December, 1894.—"The Chino-Japanese War: the Battle off the Yalu" (E. Weyl). "Yachting News." "The River Flotilla for Madagascar." "Naval Chronicle, Home and Foreign." 8th December.—"The new Constructions for 1895" (E. Weyl). "Yachting News." "Naval Chronicle, Home and Foreign." "Cruise of the Yacht 'Chazalie' in the Mediterranean" (*continued*). "Notices of Books." 15th December.—"The Navy in Parliament" (E. Weyl). "Yachting News." "Cruise of the Yacht 'Chazalie' in the Mediterranean" (*continued*). "The Battle off the Yalu" (with plans). "Naval Chronicle, Home and Foreign." 22nd December.—"New Naval Facts" (E. Weyl). "Yachting News." "The 1st class Cruiser 'Tourville'" (with plate). "The cruise of the Yacht 'Chazalie'" (*continued*). "Naval Chronicle, Home and Foreign." "Notices of Books." 29th December.—"The Battle-ship 'Magnificent'" (E. Weyl). "Yachting News." "The 3rd class Cruiser 'Coetlogon'" (with plate). "The 5-ton Cutter 'Rip'" (with plans). "New Marine Water-tube Boiler" (with plates).

Le Moniteur de la Flotte. Paris: 1st December, 1894.—"The Enquiry into our Sea-going Torpedo-boats" (Marc Landry). "The Report of M. H. Brisson." "New Method of Using Petroleum Fuel." "Madagascar." "Naval Chronicle: Home and Foreign." 8th December.—"The Sphere of Action of our Ships" (Marc Landry). "The Modifications of the Annexe of New Constructions." "The Dress for the Seamen of the Fleet." "Naval Chronicle: Home and Foreign." 15th December.—"The Defence of the Coasts" (Marc Landry). "The Minister of Marine on the Budget." "The Navy in Parliament" "M. Galibert's Collapsible Air Lifebuoy." "Naval Chronicle: Home and Foreign." 22nd December.—"The Enquiry into our Sea-going Torpedo-boats" (Marc Landry). "The Navy in Parliament." "Naval Chronicle: Home and Foreign." 29th December.—"The Enquiry into our Sea-going Torpedo-boats," (*concluded*) (Marc Landry). "The Navy in 1894." "The Navy in Parliament." "Naval Chronicle: Home and Foreign. "Notices of Books."

La Marine Française. Paris: 10th December, 1894.—"The Postal Services of the Mediterranean" (Rear-Admiral Coulombeaud). "The Defence of the Coasts" (Rear-Admiral Réveillère) (*concluded*). "The Military Objections to the Bordeaux and Mediterranean Canal" (*concluded*). "River Navigation." "Geographical and Colonial Movement." "Naval Chronicle, with photograph of 'Magenta' on her steam trial." 25th December.—"The Battle off the Yalu." "The Constitution of the French Navy." "List of English Warships completed under Naval Defence Act." "Geographical and Colonial Movement." "England and Tangier." "Naval Chronicle: Home and Foreign" (with photograph of English battleship "Centurion"). "Mercantile-Marine News."

GERMANY.—*Marine Rundschau.* Berlin: December, 1894.—"The Surveying Work of H.I.M.S. 'Möwe' in East Africa, 1891-93" (with seven plans). "Translation of Lieutenant Calthorpe's Prize Naval Essay" (*continued*). "Report of Corvette-Captain Graf von Baudissin, of H.I.M.S. 'Iltis,' on the Events at the Seat of War in North China" (with six sketches). "Naval Chronicle: Denmark, England, France, Italy, Russia, United States." "Promotions and Appointments." "Notices of Books."

ITALY.—*Rivista Marittima.* Rome: December, 1894.—"Some Considerations on the Loss of the Victoria" (with plates) (G. Russo, Engineer, 1st Class, Italian Navy). "Electricity as a means of Propulsion, a plea for Electric Boats and Ships of War" (*continued*), (G. Martinez, Italian Navy). "A Glance at the General Conditions of the Art of Navigation among the Ancients." "Political Conditions and the Revolutions in Corea." "The Naval Battle off the Yalu," with maps. "Bow and Broadside Fire" (with plates). "The Question of Madagascar." Letters to the Director: "Ostriculture," "Method of determining the Electrostatic

Capacity of any Condenser without the use of a Condenser of known capacity" (*continued*). "Naval Notes: Austria (with photograph of new armoured cruiser 'Maria Theresia'), Denmark, France, Germany, England, Italy, Portugal, Russia, United States." "Artillery, Torpedoes, and Explosives, Trials in Austria, England, Russia, United States." "Notes on Mercantile Marine." "Book Notices."

RUSSIA.—*Morskoi Sbornik.* St. Petersburg: October, 1894.—"Instructions in regard to the Duties of the Harbour Police." "Regulations for the Promotion of Seamen." "Rules of the Neva Yacht Club." "The Surface-movements of the Baltic."

SPAIN.—*Rivista General de Marina.* Madrid: December, 1894.—"Adjustment of the Needle for Observations on Horizontal Force." "Geology on the Existence of Carboniferous Soil in the Sahara." "Naval Education." "Help for the Injured and Shipwrecked in Naval War." "The Battle off the Yalu." "Vocabulary of Powders and Modern Explosives." "Naval Chronicle, Home and Foreign." "Floating Beacons and Luminous Buoys."

UNITED STATES.—*Proceedings of the United States Naval Institute.* Volume XX. Annapolis: No. 3, 1894.—"Naval Department Organisation." "The Manufacture of Heavy Ordnance and Armour; their Ballistics and Resistance." "Orders and Signals of the Venetian Fleet, commanded by M. Jas. Dolfin, A.D. 1365." "The Dygogram; its Instruction, Description, and Use." "Naval Ordnance." "Professional Notes, Home and Foreign." "Review of Commander Sturdee's Prize Essay, by Lieut-Commander Wainwright, U.S.N." "Book Notices."

The United Service. Philadelphia, December, 1894.—Has not been received up to time of going to press.

MILITARY.

AUSTRIA.—*Die Reichswehr.* 5th December.—"Can England Make War," report of an article by Karl Bleibtreu, a well-known German writer; appeared originally in the *Kölnische Zeitung*, prophesies our coming downfall, and indulges in much vituperation; worth reading as an indication of the astounding ignorance of foreigners in general and of Herr Bleibtreu in particular. 12th December.—"The Austro-Hungarian Navy;" 14th December.—"Slow Promotion." "Cossacks in Combination with Regular Cavalry." 16th December.—"Law and Duty." "The Turkish Navy"; worth reading. "The Training and Tactics of Infantry"; unimportant. 19th December.—"More About Slow Promotion." "The Turkish Navy"; these two articles are signed Hassan Ahmed, who is usually well informed; they deal only with the *personnel*, which is represented as both inefficient and hopelessly inadequate. "The Military Works Department and its Assistants." "The Aluminium Soldier," an amusing skit on inventors. "Japanese Humanity," evidently written before the fall of Port Arthur. 24th December.—"The Fighting Efficiency of Warships." 28th December.—"The Fighting Power of the Mahdists"; the notes in this journal from Constantinople and Russia are always worth reading.

Organ der Militair Wissenschaftlichen Vereine. Vienna.—"Preserved Foods" and their Importance in Field Operations"; a long and very thorough study of this important subject. "Military Surgeons as Instructors in the Military Educational Establishments." "Book Notices," etc.

Mittheilungen uber Gegenstande des Artillerie und Genie Wesens—"The Fortress Manœuvres round Paris, 1894"; carefully collated from the press with excellent maps. "Experiments with Hebler projectiles for Small-Arms"; verdict unfavourable. "Reorganisation of the Russian Engineer Corps."

FRANCE.—*L'Avenir Militaire*, 4th December.—"Our Skeleton Batteries" reveals the state of the batteries not belonging to the frontier corps; they appear to be practically denuded of men for drill and training. Worth reading. "River and Coast Transports for Madagascar," from *Le Yacht*. "Land Transports for Madagascar"; practical hints by one of the Tonkinese Expeditionary Corps. "The Occupation of Madagascar," queries the sanguine views of the Colonial Party. 7th December.—"Cavalerie a tout faire," describing the i ternal condition of French cavalry regiments; the evil of employed men seems even more serious with our neighbours than it is with ourselves; should be carefully studied. "The German N.C.O."; a careful survey of the conditions of service in Germany; *L'Avenir* calls particular attention to the fact that no power of punishment is delegated to the German N.C.O., and recommends this point strongly to the attention of the French authorities. "Military Attachés in Paris"; reprint of an important article in the *Journal de Genève*, with comments. "The Water Supply in Madagascar"; gives an analysis of different sources of supply, which we are glad we shall not have to drink. "Colonisation in Madagascar." 11th December.—"The Railway from Maevatanana to Tananarive"; discusses an article in the *Journal des travaux publics*, strongly advocating a railway, on economic grounds, and prophesying a rate of advance of 4,400 yards per diem. "Military Contractors," *apropos* of the trial of a merchant named Allez, for supplying defective water-bottles to the Army; *L'Avenir* calls it a second "affaire Wilson," though on a far smaller scale. "The Budget before Parliament." "Telegraphic Communications between France and her Colonies," on the report of M. Cabart-Danneville, laid before the Chambers; points out the importance to England of having all the lines of communication practically in her hands; well worth study. "The Trial of Captain Romani," full details from the *Esercite Italiano*; Captain Romani appears to have merited his punishment for not understanding his business, as spy, better than to go about with compromising papers on his person. 18th December.—"The Court-martial on Captain Dreyfus"; throughout this month's issue this paper deals with this case with a judicial impartiality far above any other with which we are acquainted. "The Responsibility for the Events of 1870," review of Emille Ollivièr's work, and the Memoirs of General Ducrôt; worth reading. 21st December.—"The Anglo-Italian Alliance in the Mediterranean"; should be read; *L'Avenir* concludes with a warning that to go to war with England under existing circumstances would be a folly that could only benefit Germany. "Article 84 on the Law of Recruiting"; this article gives the right to men with five years' service to register their names for civil employment under certain headings "The Case of Captain Dreyfus." 28th December—"The War against the Hovas." "Our Effectives on the 31st of December." "More about Captain Dreyfus."

Revue du Cercle Militaire—"Combined Field Glass and Compass by Lieutenant Géraud," with illustration; the idea seems excellent if it will stand rough usage in the field. "The Tactics of Infantry," no originality. "Electric Projectors and their Use in the Field," with plates. "Discipline in the Swiss Army." "The Re-organisation of the Italian Army."

Revue Militaire de l'Etranger. December, 1894.—"The German East African and Colonial Troops," based on Wissman's letters in the *Militair Wochenblatt*. "The German's Regulations for Field Service, 1894," useful summary for those who cannot read the original. 'The Chino-Japanese War,' chronicle without comment. "The Military Organisation of the Ottoman Empire."

Revue d'Artillerie. December, 1894.—"Schneiders 7·5-centimetre Quick-firing Gun, for Field Service," weight of shell 14 lbs., initial velocity 1,900 feet, weight behind team with filled limber 36 rounds 31 cwt. (with plates and photographs). "Artillery in Combination with the Other Arms," translated from the Russian. "Distribution of Deformations in Metals Under Strains and Compression,

Torsion, Shearing." "German Siege and Fortress Artillery Material." "The Strategic Railways of the Black Forest."

Revue Militaire Suisse. December, 1894.—"Colonel T. de Vallière." "The Manœuvres of the VIIIth Division." "Hygiene and Food of the Troop Horse on Service." "The Madagascar Expedition." "The Vaudoise Society for the Special Arms."

Journal des Sciences Militaires. December, 1894.—"The Spirit of the Regulations for Manœuvres of 1894." General Lewal; critical study of the French and German Regulations, worth study, like everything the author writes. "The Truth about the 'Role Social' of the Officer," pessimistic, but worth reading; key note given by the following sentence: "Q'attendre en effet d'un peuple qui ne croit à rien ou à personne." "Dernier Effort," by General Philebert. "The Fortifications of the Belgian Meuse and the Northern French Defence in a Franco-German War," read. "The Campaign of 1814," by Commandant Weil. "The Action at Nuits, 18th December, 1870."

La Spectateur Militaire. 15th December, 1894.—"Les Bourcet, and their role in Alpine Warfare," record of the topographical services of this family, who for generations have devoted themselves to the study of this frontier. "The Manœuvres of 1894," Brun: sensible comments; it appears that much delay in the circulation of orders was occasioned by the time each recipient took to work out the orders for his own command; the orders themselves were rapidly delivered by cyclists once they left the offices. "The Fourth and Last Volume of Constant's Memoires of Napoleon," Noel Desmaysons, review. "The Old Army," Boisonnet's organisation of the supreme command at different periods in the French Army.

Revue des Deux Mondes. November.—"The last Army of the Empire (1815)," by M. Henry Houssaye; should be read. "French Railways," by M. Raphaël-Georges Lévy; very interesting. December.—"L'Assaut de Loigny (2nd December, 1870)," by M. Art Roë—compare Kunz and Hoenig's accounts. "Madagascar and French Colonization," by M. le Vicomte Eugène-Melchior de Vogüé, de l'Académie Française. "An unpublished Episode of the Soudan Campaigns, 1884-5," by M. G. Valbert.

GERMANY.—*Militär Wochenblatt.* 1st December, 1894.—"The Imperial Manœuvres, 1894." "The Shortest Way to Constantinople" deals with several articles which have appeared in foreign and native papers on Captain Stenzel's original pamphlet; well worth reading. "Africa, Rules for the Preservation of Health in the Tropics," Major Wissmann, contains nothing new or of special interest. 8th December.—"The Imperial Manœuvres, 1894" (*conclusion*). "The Battle of Orleans," by Major Keim. "The Mobilisation of the Russian Army." "The French War Budget, 1895." 12th December.—"Ironclads on the Yalu." "The Mobilisation of the Russian Army" (*conclusion*). 15th December.—"A Run with the Hannover Drag Hounds, 12th July, 1894"; 149 started; ground, heather, and sand, with a few jumps; distance, sixteen miles, covered in fifty-one minutes for the best; about one hour average; no serious accidents. According to Müffling, "if the Duke added the word quick" to a galloper, it was a point of honour to cover eighteen miles in the hour in the British Peninsular Army. "The Bocche di Cattaro." "The Re-organisation of the Austrian Engineers." 19th December.—"The Wood Fighting Around Pourpry on the 2nd December, 1870," by Major Kunz. "The Bocche di Cattaro." "The Armament of Modern Fortresses." "Manœuvres in Roumania." 22nd December.—"A Brave Deed." "The Effect of Field Artillery Fire," review of a book by Lieut-General Müller, a well known writer on artillery questions, deals chiefly with experimental results obtained with shrapnell on the continent. "The Riding School," worth reading. 29th December.—"The Close of the Year." "The Effect of Field Artillery Fire," interesting only to experts. "The Riding School," chiefly about Plinzner's book. "Artillery Notes," practical hints.

Deutsche Heeres Zeitung. 4th December.—"Madagascar," summary and critique of articles in the *Avenir Militaire* (*conclusion*). The French are underrating the difficulties before them. "Modern Reserves" runs through the whole month's issue, diffuse, but suggests many problems worth close thinking. 8th December.—"Some Reflections on the Capture of Port Arthur" indicates the many contradictions in available reports, and warns against jumping to conclusions. 12th December.—"The French Artillery," based on articles in the French press about the new quick-firing guns, recommends France, if she has any money to spare, to expend it in increasing the peace strength of her infantry cadres. 15th December.—"The Navy Estimates." 22nd December.—"An Answer to the Pamphlet, 'Our Cadette Corps.'" 29th December.—"Our Cadette Corps" (*continued*). Worth reading, for those who wish get at the true nature of the training of the young German previous to entering the army.

Neue Militairische Blatter.—November.—"The Native Cavalry of India"; deals with the organisation of our native regiments, but says nothing about their manœuvring capacity. "The Military Importance of the Defiles of the Upper Rhone Valley." "Norse Opinion of German Sea Power," by Vice-Admiral Batsch. "The Cavalry Divisions of the Third and Meuse Armies in the Operations round Chalons." "The Chino-Japanese War." "Notes on the Progress of the Field Artillery." "The Fundamental Principles of Remount Training"; worth reading. "Russia," review of military literature in 1893; read. December.—"Critical Studies of the Operations in 1864 up to the Capture of the 'Dannewerk.'" "Norse Opinion of German Sea Power." "The Capture of Kassala by the Italians." "The Chino-Japanese War." "The 'critiques' of General Dragomirow"; should be carefully read. "The Fundamental Principles of Remount Training." "Notes from Russia"; very interesting.

UNITED STATES OF AMERICA. — *The United Service.* January. — "Readjustment of Rank." "Recollections of Ericsson." "The Organisation and Administration of the Lines of Communication in War," review of Colonel Furse's book, by Captain H. G. Sharpe, U.S.A.; favourable. "Origin and Development of Steam Navigation," by the late George H. Preble, Rear Admiral U.S.N. "Notes on Photography." Notes, etc.

NOTICES OF BOOKS.

Kriegslehren in Kriegsgeschichtlichen Beispielen der Neuzeit. By VON W. VON SCHERFF, General der Infanterie z D. Berlin: Mittler, 1894. Price, 12s., 2nd Volume. Betrachtungen uber die Schlacht von Vionville-Mars la Tour, 16th August, 1870.

The main points of von Scherff's method and of his views were, we trust, sufficiently brought out in our previous notice of the first volume of this series, in the October number of this Journal. From that article we have nothing to withdraw, and nothing either to add. Indeed, the work before us serves only to accentuate our conviction, already expressed, that, in the main, Scherff is fighting with spectres of his own creation, possible consequences of the logical rendering of the new German Infantry Regulations—consequences which certainly might ensue if these regulations were entrusted for guidance to a body of lawyers untrained in the art of "playing together" on the manœuvre ground, but which the practical training, to which the German officers are, as a fact, subjected, renders too remote a contingency for consideration.

This particular volume possesses a value entirely its own, in so far as it is the most exhaustive and critical work which has yet appeared on the battle of Vionville-Mars la Tour. Hoenig's work, "Die zwei Brigaden," which preceded it, deals with only a fraction of the whole day's work, and Hoenig could only speak as *best evidence* on the fraction of events which happened within the cognisance of his own senses; where he strays outside that limit, Scherff has very little difficulty in showing him up as a hearsay witness of ordinary type. Two-thirds of Hoenig's work is taken up in an attempt to prove that General Schwartzkoppen made blunders of an altogether inexcusable character in launching the 38th (Wedell's) brigade against an unshaken and numerically vastly superior force. About the same proportion of Scherff's book consists of an absolute refutation of Hoenig's view. Now, Scherff was von Schwartzkoppen's staff officer, and Hoenig was only a regimental adjutant, and where Scherff speaks with absolute knowledge and at first hand, his would be the better evidence in any court of law, even though Scherff cannot be altogether regarded as unprejudiced, since the Chief of the Staff and the Commanding Officer are, in all services, somewhat intimately related.

Though Scherff differs with Hoenig on these points which touch himself and his chief, he accepts, almost in their entirety, his statements as to the events in the fighting line, of which Hoenig himself was an eye witness, and where he differs he makes the evidence for the views as to the attack formation, which we have consistently advocated, if anything, still stronger, though, whilst doing so, he himself still fails to grasp the whole point.

Scherff is, and always has been, an opponent of the extreme "go-as-you-please" school of tactics, and equally of the extreme "bayonet-shock" people. In these studies he conclusively demonstrates the folly of both; on the one hand, by the example of the 12th Brigade between Vionville and Flavigny; on the other, by the disaster which overtook the 38th Brigade at Mars la Tour; and for both he recommends an advance in a "normal order of individual fighters," not skirmishers or line, which he has advocated for years past in his somewhat voluminous writings. But he ignores throughout the central feature of both attacks, namely, the extreme difference of the arms in use on the opposing sides. Now, no one believes more firmly than we do in the principle that it is the man behind the gun, not the gun itself, which decides, yet there is moderation in all things, and when the disparity of armament is as great as it was in 1870 it is time to draw the line. The German needle gun was exceedingly inaccurate at 500 yards, the Chassepot killed at 2,000, and could, moreover, be fired about twice as fast, that is to say, that the disproportion which existed between the two armaments was greater than it would have been had the French been armed with good old long-bows, and far greater than it actually was between Austrians and Prussians in 1866, for the Lorenz rifle of the former had a longer range and flatter trajectory than the needle gun, was safer to use from the shoulder owing to the non-escape of powder gas from the breach, and the difference of rate in firing, not so great as is usually imagined, could be obviated, at least in defence, by suitable tactical formations, as the Americans abundantly demonstrated.

Take the cases Scherff cites as typical, and substitute for the weapons actually in use arms of equal power on both sides, then, though the attack of the 12th Brigade would have failed just as it actually did, because, its constituent elements diverged from their prescribed path in accordance with the vicious principles of the "go-as-you-please" style, the 38th Brigade would have gone near to establish the first elements of success had they only been able to halt and reply to their enemies' fire before all cohesion was lost under the hail of lead to which they were exposed, and to which their armament rendered it impossible to reply. We say "might have established the first elements of success" with a definite intention. More they could have hardly hoped to attain in view of the enormous numerical superiority with which they had to contend; but, even eliminating this factor of

numerical superiority, their prospect of ultimate success was largely reduced owing to the fact that, true to the Napoleonic traditions of skirmishers and small columns, in which they had been trained, they primarily brought into action only one-half of the fire-power they might have developed. Form the two brigades in two lines with a small reserve, company intervals, for flexibility, and 500 yards between the lines, and note the consequences.

In the case of the 12th Brigade they would not have been diverted from their true direction by the search after covered approach, as Scherff states that they actually were; in all human probability they would have carried the position assigned them as an objective at the first rush, and thus escaped nearly two hours of unnecessary exposure, and the companies would have retained in the main their integrity ready for employment beyond the limits of the conquered position.

In the case of the 38th Brigade; since those companies, which actually did adhere to line two deep, reached the extreme limit of the advance under sufficient control to deliver volleys, and actually lost fractionally fewer men in so doing; it is at least reasonable to suppose that, had their armament admitted of their halting 300 yards short of the ravine which gave shelter to the French counter attack, and from thence opening a controlled fire equal in intensity to that by which they were opposed, their prospect of victory must have been enormously improved; and since they hung on, even as matters actually stood for some minutes to the edge of the ravine at which their advance came to a stand, it is also only reasonable to assume that they would have held out 300 yards further back appreciably longer, and thus given time for their supporting line to come to their assistance. Now, since at that part of the line where the sheltering ravine did not assist the French counter attack, viz., on the extreme left, the French themselves admitted that another two minutes would have broken their rush, it is surely not too much to conclude that, under the circumstances we have supposed, the fire superiority would have remained in the hands of the Germans, and whether that fire superiority was utilised or not, is apart from all tactical interest, and rests only with the staff and their employment of the troops available. There are yet some other points in Scherff's work that deserve special attention.

First.—The consequences of Moltke's initial mistake in assuming in his directions to Prince Frederic Charles, issued on the 15th, that the whole French Army was in retreat on the Meuse. This mistake entails no blame on Moltke, for it simply passed the wit of man to imagine the blunder which the French staff actually perpetrated, viz., the massing of three-fifths of their forces on one road only, and the subsequent mismanagement of the trains on that road; but the result was far-reaching, for when, on the morning of the 16th, the troops in full march on the Meuse heard the firing on their right rear, they took it as coming from a mere rear-guard encounter, or, perhaps, merely the fire of the guns of the fortress, and hence they did not turn back as quickly as they might otherwise have done. Next comes the want of enterprise shown by the cavalry, assuredly not due to any deficiency of courage on their part, the events of the day completely refuting that suspicion, but entirely to the fact that, as a body, they had not been taught to utilise their mobility, and failed to appreciate their potential capacity. Let the student of the battle substitute in his imagination the existing regiments for for those of 1870, and note the consequences. The present cavalry would have been round across the Bruville heights before 11 o'clock, and all the mistakes which arose through ignorance of the true condition of affairs would have been nipped in their inception.

Then note the consequences involved by the ignorance of the superior leaders of the defensive powers of their own artillery. Had it been generally recognised that the guns were quite capable of holding their own against any frontal attack, nine-tenths of the fruitless but bloody desultory efforts of the infantry would never have been made at all, and taking the saving in order and in life resulting from

these two factors together, it is evident that when the crisis of the action really arose there would have been a large force in hand to meet it. Lastly, we would recommend our readers to take the situation as it actually was at any hour in the forenoon, and work out the consequences which would have resulted from the existence of a reliable means of signalling from column to column. The distant columns might have countermarched two hours sooner, and their arrival on the ground might—indeed, most certainly would—have obviated the necessity for Bredow's charge, the severe maltreatment of the artillery on the left wing, and the final catastrophy of Wedell's brigade. Taking all three factors together, it is tolerably certain that there would ultimately have been a sufficient force in hand to have enabled the Germans to thoroughly defeat their enemy, whereas neither signalling nor any other factor, saving only the absence of personal jealousies on the part of the French staff could have averted the result. It was not so much capacity which failed these latter as the want of mutual trust and reliance which comes from the habit of "playing together."

Report on the Employment of Retired Soldiers and Sailors. — 3rd August, 1894. London: EYRE AND SPOTTISWOODE; price, 1s. 4½d.

This report should be studied by every officer of the two Services, for there can be no doubt of the fact that the quality of the recruits we receive is almost entirely dependent on the attractions in the shape of employment on leaving the colours we can hold out to the men on entering the Service. Let it once become well known that from the day a man joins he need never again, except as a consequence of his own idleness or misconduct, feel the pinch of want, and a very superior class of men may be relied on to stream in to our ranks. Already, this report shows, matters are improving: employers are beginning to realise that the seven years' service man is a very different person for their purposes than the old pensioner; he is young, still in the prime of life, better educated, and of more individuality, and the consequences are that not more than 10 per cent. of the reserve men can be shown to be out of work. Compare this with the proportion of men unemployed in many of the skilled trades, and the state of things must be admitted to be very satisfactory, more especially when the employment of these men, or their chances of obtaining any, previous to enlistment are dispassionately considered. On this point no accurate figures are obtainable; still, if our readers will look back on their own experiences of the class of recruits taken up during the past twenty years, we think they will admit that not one half of them had work at the time of enlistment, or any reasonable prospect of obtaining it. The net result, therefore, is this, viz.: that as a consequence of their military training, 40 per cent. of the men joining are in a markedly better position than they occupied previous to enlistment. It is less satisfactory when we consider the class of employment obtained by them. In the civil struggle for existence every man soon finds his proper level, and hence we may presume that the men are not at present fit for better or more remunerative work than they have actually secured. If this is so then it points to a serious want in our military training, and by the aid of the evidence before us we can place our finger on the very spot. It is not want of skill in the use of tools, etc., that is therein laid to their charge, but want of grit to assume responsibility and want of character to resist temptation. Now, the whole purpose of all modern military training is the evolution of these very qualities, for discipline, *i.e.*, fighting efficiency, is absolutely dependent on them; and if, after seven years of this education directed to this special end, our men are not better than those who have not enjoyed their advantages, there must be something wrong in the methods we are employing. It would carry us far beyond the limits of our space, or of our office, to indicate these faults at length; it will suffice, perhaps, to say that they are not inherent in our regulations, but are solely due to errors in their application, these errors again being the consequences which inevitably follow any abrupt change of system and which work themselves out in course of

time with more or less rapidity according to the degree of intelligence that each individual in the Service brings to his work and the loyalty with which he supports the new system. The essence of all sound reform is that once the impulse is given from outside, forces are developed inside the organism which ultimately enable that organism to work out its own salvation. Progress at first is necessarily slow, but as the idea radiates from the centre outwards it increases in geometric progression, and signs are not wanting that it is doing so even now. Give us another ten years free from the heroic methods of faddists, and we venture to prophecy that our reserve men will no longer have to content themselves with such work as "car drivers, tramway men, labourers," etc., but that their value will be better appreciated, and employers will be eager to secure them as responsible men for the superintendence of work, posts for which their training should pre-eminently fit them: it lies primarily in the hands of the regimental officers whether this end is attained or not.

Might not something further be done to popularise the Military Service by the grant of land to reserve men in the Colonies for settlement. Hitherto such attempts have generally failed, for the old soldier, trained to machine-like precision only, was too helpless to shift for himself, nor had he learnt anything to qualify him for such occupation. The new soldier, trained to intelligent obedience and taught the elements of rough pioneering, ought to possess a distinct value to the men engaged in the opening up of new territories; and that some of them do possess these qualifications we can vouch from personal experience in India, where men of all branches of the Service have been employed under us, in the superintendence of working parties on roads, barracks, etc., and have uniformly given satisfaction, often most intelligent assistance. The presence of these trained men on dangerous frontiers, pledged, in return for their land grants, to give their military services if called upon, could only be beneficial, and the difficulty of depleting the reserve could be got over by allowing them to provide a substitute from the ex-reserve men, subject to his being physically fit for the purpose. Probably not two per cent. per annum would elect to go, and even without replacing them, this loss might be borne for the sake of the additional popularity this fresh opening would confer on the Army.

Memoirs of the Prince de Joinville. Translated from the French by Lady MARY LOYD. London, Heinemann, 1894. Price 15s.

This book comes like a gleam of sunshine across the dreary path of the reviewer. Every page is full of incident, wittily described, and nowhere does the author strike even slightly the false chord of Chauvinism nowadays, unfortunately, so terribly prevalent in French literature. It is impossible within the limits of our space to do adequate justice to its pages, we can only give a few extracts to whet the reader's appetite for more.

After being entered for the Navy at the earliest age feasible, he served for some time as A.D.C. to the King, his father, and in that capacity frequently came under fire, for, like the Irish landlords, the poor King enjoyed no close time whatever. How common these attempts at assassination became is indicated by the following conversation *àpropos* of the failure of Meunier's attempt made in 1835, at the opening of the Chamber of Deputies. After the King had left the Chamber, as the members were talking over the event, one of them asked, "Ought we to congratulate the King?" "Certainly," was the reply, "we always do it."

Some of these attempts were deadly enough to the staff if not to the King, witness the following. As the members of the procession to accompany the King to a grand review of the National Guard on the Boulevards, was assembling at the Tuileries, Thiers, then Minister of the Interior, burst in like a whirlwind, told the two princes that an attempt was to be made on the King near the Ambigu, and asked, "'Should the King be warned? Should the review be postponed?

We answered that the King must certainly be warned, but that brave as he was well known to be, he would never consent to postpone the review, and so it turned out. 'Look well after your father,' repeated M. Thiers as we rode off.

"One of us with an A.D.C. was to take it in turns to keep just behind the King so as to interpose if we noticed any suspicious gesture. My turn had come to take the post of watcher with General Heymès on my right, on my left, Lieut-Colonel Rieussec. Close to the Ambigu we heard a sort of platoon firing, and raising my eyes towards the noise I saw smoke coming from a window which was half closed by an outside shutter.

"I had no time to notice more, and at the moment did not perceive that my left-hand neighbour, Colonel Rieussec, was killed, that Heymès clothes were riddled with bullets and his nose carried away, and that my own horse was wounded. All I saw was my father holding his left arm and saying to me over his shoulder," 'I am hit.' And so he was. One bullet had grazed his forehead, another had given him the blow of which he complained, and a third had passed through his horse's neck. The King was led out of the danger, the house was stormed by the other A.D.C.'s and police, and the review began again. "Thereupon Thiers appeared behind us, his white trousers all covered with blood.

"'All he said was, 'the poor Marshal.'

"'Whom do you mean?'

"'Mortier. He fell dead across me crying out, "Oh, my God."' We reckoned ourselves up as we went along. Forty-two dead or wounded. Dead: Marshal Mortier, General Lachasse de Verigny, Colonels Raffet and Rieussec, Captain Willatte, seven others, and two women. Wounded: Generals Heymès, Comte de Colbert, Pelet, Blin, and many others."

Surely a somewhat rough *baptême de feu* for a boy of sixteen.

In 1840, being then in command of "la Belle Poule," he was sent out to St. Helena to bring back the bones of Napoleon, and his description of the final scene when the coffin was handed over to his charge by the British authorities is expressive in its simplicity and perfect taste. What happened on his arrival in France shall be told in his own words. "At St. Helena things had been done by the British Army on the one part and our seamen on the other, with the chivalrous seriousness and dignity which always attends the relations of those who wear the sword. In France the conveyance of the remains took on quite another character. It was first and foremost a show in which, as always happens in our country, many people desired to play a part which was inappropriate and sometimes ridiculous. I had often to interfere to get matters put right."

The fighting in Algeria seems to us never to have attracted the degree of attention it deserves, and the following extracts are, therefore, given in the hope that they may induce some of our readers to accord it the study it undoubtedly merits. Obtaining leave from the Captain of his ship to go up country and visit his brother the Comte de Nemours, who commanded one of the brigades before Constantine, he hurried forward by forced marches, but delayed by storms of rain, he only reached the place the day after it had fallen. Going over the breach he came on a sentry beside a big stone, and to his inquiry as to what he was doing, the man said, "'Do you see that bit of blue cloth down that hole? The Colonel is underneath that stone and the bayonets sticking out of the rubbish belong to the men he was leading. The explosion buried them all.' A terrible trial that explosion was for the assaulting columns, fired at from all sides by an invisible foe. But nothing dismayed our brave fellows for an instant. When the staff, which was following the progress of the fight with anxious ears, for there was no seeing anything, saw the cloud of smoke caused by the explosion shrouding the breach, and hundreds of wounded, burnt and maimed, coming back from it, they thought the assault had been repulsed and that the game was up. Lamorricière, commanding the first attacking column, was carried back blinded, and to everybody's astonishment the commanding officer of the second column,

Colonel Combes, was seen returning also. He advanced, sword in hand, to the General commanding, over whose face an expression, first of wonder, then of anger, spread, at the sight of a commanding officer quitting his post. Nothing daunted, the Colonel informed him in a few curt sentences of the state of the fight and of his own confidence in its success, ending with these words, 'It will be another glorious day for France and for those who live to see it.' He saluted, tottered and fell dead. No sign of his had betrayed that he was mortally wounded. As I listened to the tale I asked General Vallée, 'But what would you have done, General, if the assault had been repulsed.' 'We should have begun again.' As he said it he pressed his lips together with that fearfully stern expression which, with his short stature, had earned him the name of 'Little Louis XI.,' and an officer behind me who had heard my question and the answer added, in an under tone, 'And he had taken all his precautions.'

"'What do you mean?'

"'When he was told the night before the assault that the ammunition was giving out he ordered one round to be kept in reserve for the battery that played upon the breach.' 'Well?' 'Don't you understand? He meant to fire on the attacking column if it gave any sign of wavering. He did it once before in Spain, at the siege of Tarragona.'"

Whilst sketching next day at the breach he heard a bugle sounding a march and soon saw the bugler coming out upon the breach. Behind him followed a sub-lieutenant, sword in hand, and then in place of the men came a string of donkeys led by about a dozen Zouave irregulars. "Puzzled, I asked the bugler what he was blowing for. 'Why,' he replied, 'this is the volunteer company from Bougie going back to headquarters.'

"'What?'

"'Those are the rifles on the donkeys there. Everyone was killed in the assault. *There is nobody left but us.*' He began blowing again, the donkeys passed on, and I bared my head to them."

"On the 18th October, I was present at the military funeral of the Comte Damrémont. It was a moving sight. Some few hundred yards from the spot where he had been killed, just at the foot of the breach, a cenotaph had been built of sandbags, on which the coffin, with the General's cloak, his sword and plumed hat had been placed. It was a very gloomy day. The whole Arab population was looking on, squatting on the walls. On the top of the breach were planted the colours of the 47th Regiment. Below it the Zouaves' drums rolled a funeral march, whilst the officers saluted the remains of their gallant leader for the last time. And what officers they were, too! How many future men of mark there were in that assemblage, which, not to mention its chiefs, numbered Captains Niel, Canrobert, MacMahon, St. Arnault, Le Boeuf, Ladmirault, Morris, Leflô, and many others."

How came it, one cannot help asking, that men trained in such a school as this should yet have failed against the school-taught, barrack-square drilled leaders and men of Germany? and the answer, if one goes into the matter to its very roots, will be found in these, his concluding reflections on the fall of the monarchy in 1848. "And yet even so late in the day, in other countries than our own indeed, generals and others invested with the chief command of the national troops have been known to draw their swords and save their sovereigns and their governments almost in spite of their own selves. They have been known to maintain the inviolable principle of a traditional monarchy, tracing the line of duty for all men, clear and indisputable, without any possibility of hesitation or compromise against, and in the face of, all comers. And this principle is one which calls forth the proudest devotion, seeing it is impersonal, for the King is not the elected leader of conquerors, oppressing the conquered, but a living flag, the national rallying point for all the defenders of the country against her enemies, whether within or without her borders." Apply this line of thought to the history

of the evolution of the modern German armies and it will, we think, be apparent that but for this traditional devotion to a crowned head not even Moltke's talents and capacity would have availed to secure amongst princes and officers that degree of self-abnegation on which the successful application of his plans practically depended, and whose absence on the other side primarily induced the disasters round Metz, which the gallantry and devotion of the junior ranks were alone unable to avert.

Indian Polity. A view of the system of administration in India. By General Sir GEORGE CHESNEY, K.C.B., R.E. Third Edition. London: Longmans, Green and Co., 1894. Price 21s.

Since, in the main, the evolution of our Indian polity during the past twenty-seven years has followed the lines originally laid down in the first edition of this work, it is fair to anticipate that for the next quarter of a century or more the same process will continue, and this affords us a scale by which to measure the importance of this book, and a justification for recommending its perusal as strongly as we can to all who have the interests of our Empire at heart. No one who reads it intelligently and with a mind free from prejudice but will be convinced that our position would be markedly strengthened by the steps therein indicated, and in proportion, as each, in his individual capacity, assimilates the spirit of this work, the friction which inevitably hampers the initiation of any reform, will be reduced, and progress facilitated.

The chapters on the Army will probably attract most attention from the members of this institution. For twenty years and more Sir George has consistently advocated the centralisation of the Indian armies into four army corps, but he now points out that events have moved faster than reform and the change so recently sanctioned is already too limited for the new needs that have arisen. Seven distinct commands are the minimum that would satisfy him now; and without going into a long disquisition on the organisation of armies in general and the Indian army in particular, it will be sufficient to call attention to the following figures to show a strong *primâ facie* case for the General's views:—Bengal army, 70 000, Punjab army, 56,000; Bombay army, 30,000; Madras army, 27 000. Now, since even Napoleon could only find one general (Davoust) competent to command 60,000 men, and then only when they were practically united under the leader's hand, in respect of space, what reasonable chance is there that the Indian Government will always be able to lay its hands on men to command adequately 70 000 or 60,000, disseminated over very wide areas. Space prevents us from dealing with the innumerable other points of interest the book contains, and we, therefore, conclude with the most earnest exhortation to all our readers, to give this book their very best attention.

History of the United States Navy, 1775 to 1894. E. S. MACLAY. Two Volumes. London: Bliss, Sands, and Foster, 1894. Price 31s. 6d.

In his history of the United States Navy, Mr. Maclay has produced a couple of volumes which are of great interest, and which, in spite of certain defects, are well worth perusal, especially by English Naval officers. The first part of his work is devoted by the author to tracing the maritime development of the Colonies, up to the conclusion of the War of Independence in 1782, and in this section he, naturally with some pride, details at length the exploits of the celebrated Paul Jones, giving a very spirited account of the great battle, off Flamborough Head, between Captain Jones's ship, the "Bonhomme Richard," carrying forty-two guns, and the new 44-gun frigate "Serapis," Captain Pearson, which resulted in the capture of the latter; although so damaged was Jones's own ship, that she foundered a few hours afterwards, being, in fact, only kept afloat just long enough to allow of the transfer of the prisoners and wounded to the "Serapis." The damage inflicted on British trade

during the seven years the War of Independence lasted was so considerable that one wonders at the want of precaution shown by the English Government when war broke out again in 1812.

In the second part, which covers the period between 1787 and 1805, Mr. Maclay describes the events of the war between the United States and France, which, breaking out in July, 1798, lasted for two years and a half, and was followed by a series of operations carried out in the Mediterranean against Tripoli and the other Barbary States.

In narrating the causes which led up to the hostilities with Tripoli, the author throws a curious light upon the position occupied by the semi-piratical States on the North-African seaboard and their relations with the European Powers, and if he is correct in his statements, the English Government at that time certainly appears to have acted in an underhand and unscrupulous manner; we are not in a position to say how far this was really the case or not, but as an undeniable vein of bitter hostility to England runs through the whole book, we are not quite prepared to accept all Mr. Maclay's statements as impartial and of historical value; but, having said this, it is a pleasure to record that the United States Navy may well be proud of the achievements of their little squadron against the Bey's forces. The unfortunate grounding of the 36-gun frigate "Philadelphia," under the command of Captain Bainbridge, on a reef at the entrance to Tripoli harbour, when chasing one of the Bey's corsairs, on the 3rd October, 1803, in the early days of the war, followed by her surrender, and her subsequent floating off by the Tripolitans, when she was securely moored in the harbour under the guns of the fortress and the flotilla of gunboats, afforded an opportunity a few months later to the United States squadron for as dashing a feat of arms as has ever been carried through by the officers and men of any navy. Recognising the impossibility of cutting the frigate out—for she was moored under the castle, within range of batteries mounting 115 pieces of heavy ordnance, and, moreover, surrounded by twenty-four gunboats and other armed vessels, with a full crew on board and her guns all mounted and double-shotted—Captain Preble, the American Commodore, determined to make the attempt to destroy her as she lay.

The execution of the plan was entrusted to Lieutenant Decatur, who commanded the sloop-of-war "Enterprise" and who had immediately volunteered for the hazardous undertaking. A native ketch having been captured, twelve officers and sixty-three men were embarked in her, and after a few days' detention through bad weather, a night favourable to their purpose arrived, and it must suffice to say that Lieutenant Decatur having managed to get his little craft alongside the "Philadelphia" before the suspicions of the enemy were aroused, the ship was boarded, the crew driven below or overboard, the combustibles brought for the purpose distributed over different parts of the ship and ignited, and so rapidly and effectually was the work done that in twenty-five minutes Lieutenant Decatur and his gallant little party were effecting their retreat, leaving the "Philadelphia" in flames from end to end; so taken by surprise were the enemy, that, although eventually a heavy fire was opened upon the ketch, yet the little vessel succeeded in reaching the shelter of the ships in the offing without damage. Only one man was wounded on the American side in this daring and successful exploit.

The third part of the book is devoted to the war of 1812. Mr. Maclay does his best to prove that in the celebrated actions, which resulted in the capture of the English frigates "Guerrière," "Macedonia," "Java," and some smaller vessels, the advantages on the side of the American ships were not so great as English writers have generally maintained; he, to his own satisfaction, though not entirely to ours, proceeds, in estimating the respective forces, to deduct seven per cent. from the weight of the American projectiles, on the score that owing to bad workmanship the shot never weighed as much as they were supposed to do; he then similarly adds to the nominal weight of the English shot, but, nevertheless, in spite of his manipulation, he is compelled, in his comparative tables of relative force

of the ships engaged, to admit that, with the exception of one or two smaller vessels, in the matter of tonnage, number of guns, weight of metal thrown, and, above all, in the number of men, the advantage was all on the side of the American ships; however, we shall not attempt to enter into the question ourselves; the author is probably right enough, when he attributes our defeats mainly to "over-confidence" and despising our enemy. Mr. Maclay claims that the result of the war was the almost complete annihilation of English commerce; this, of course, is a gross exaggeration. Although great damage was undoubtedly inflicted on our sea-borne trade, there is a vast difference between the infliction of great damage and annihilation.

Part IV. is comparatively short, and is devoted to minor wars between 1815 and the outbreak of the Civil War in 1861. Part V., which occupies half the second volume, is a record of the Naval operations in that great struggle, and although containing nothing new, the account the author has given of the various operations is concise, graphic, and interesting, and its perusal will well repay any reader.

In conclusion, we can heartily congratulate Mr. Maclay on his work; the book is well got up, the type good, and the numerous plans and illustrations excellent. Although in some of his descriptions of battles he writes more in the style of a Naval-novelist than an historian, that is a minor fault, and may very probably render the book more attractive to young readers among his countrymen. As, however, the author has aimed at producing a history, which he hopes to see take its place as one of the standard works of his country, we must express our regret that he gives such rein to the evident animus which he entertains against England. It is perhaps natural that he should lay stress on what he considers the unjustifiable and ungenerous attitute adopted by England towards the young State after Independence was achieved and before the War of 1812, and we do not complain of his doing so.

English readers, however, will be interested to learn that we occupied the Channel Islands in keeping with our policy of holding strategic positions on the coasts of other nations, and that our continuing to hold them is a constant menace to France; similarly we fortified Heligoland, and for many years were able to exercise a controlling influence over Germany; Gibraltar and Malta gave us a dominating influence over the Mediterranean States, while the possession of Hong-Kong threatens China; and it was only the superior acuteness of Captain Sloat, the senior American officer in the Pacific in 1842, which enabled him to frustrate the nefarious project of the English Government to seize the whole Californian coast from San Francisco down, by—although war at that time did not exist between Mexico and the United States—himself seizing the various coast-towns on the Mexican sea-board. These readings of history by the author are of course harmless, but, what is quite inexcusable, is his complete misrepresentation of the attitude of England towards the United States during the war with the Confederate States.

In maintaining, as he does, that the universal desire in England was to see the United States divided, Mr. Maclay either shows an ignorance of the real political history of that time not very creditable to an author who poses as an historian, or else his hatred of this country is so great that he cannot do us ordinary justice, which is equally unworthy of him. Mr. Maclay ought to know that had the English Government and the English people wished to break up the Union, they had a legitimate *casus belli* when Messrs. Mason and Slidell were forcibly taken from the "Trent" by Captain Wilkes of the "San Jacinto," but that so far from availing themselves of the opportunity afforded them, the English Government, on the contrary, built a golden bridge which enabled the Washington Government to withdraw, without any loss of dignity, from a quite untenable position. Mr. Maclay ought further to know that over and over again the late Emperor Napoleon III. pressed on our Government to join with his in

recognising the independence of the Southern States and breaking the blockade, but that our Government steadily refused, although at that time hundreds of thousands of our working classes in the north were on the verge of starvation in consequence of the cotton-famine, brought about by the blockade of the Southern coast. Mr. Maclay barely refers to the payment of the Alabama claims, but there again he seems to be quite unaware that the English Government so arranged the arbitration reference as to make the decision against England a foregone conclusion, and that this was done—and we believe with the practical concurrence of the whole country—with the sole object of removing all causes of ill-will from the minds of our American brethren, a result which was felt to be worth a considerable pecuniary indemnity to obtain.

In a new edition, we hope Mr. Maclay will be generous enough to do at least our Government justice, for had they adopted a different and hostile attitude, in all probability there would be no Union at the present day.

The History and Development of Steam Locomotion on Common Roads. By WILLIAM FLETCHER. London, F. N. Spon. 1891. Price 7s. 6d.

By the universal concensus of all European expert opinion, *mobility* is now the one essential factor on which success or defeat in the next great war depends. Except in England, every nation has developed its numerical resources to the utmost, armaments are everywhere on a par, each nation believes that its organisation and the training of its troops for war are the best possible for its own conditions, and only in the direction of mobility is any differentiation to be hoped for. With this object in view trains are everywhere being reduced to a minimum, the soldiers equipment lightened, even at the cost of his ammunition, and the yearly training of the troops is becoming more and more a simple preparation of the soldier for long-distance marching, and if a few men drop by the way in the course of this training, nothing much is said about it. Twenty years ago no other methods of securing mobility were available, in many countries none are even at the present day; but in England, where the need for mobility is most essential, we are fortunate in having the means to secure it placed ready to our hands by the ability of our mechanical engineers and the skill of our workmen. That this is so, the work before us sufficiently demonstrates; in some three hundred pages the author traces out the evolution of steam locomotion on common roads, and shows us the reasons why this evolution has been retarded, and how it happens that the causes for this retardation no longer exist. For these the reader must be referred to the book, which is too long to be adequately summarised here; but, stated briefly, the primary reason is this, that the quality of the materials employed, and the excellence of the skill of the workmen has increased so remarkably, that the conditions the army exacted twenty years ago, and still requires, can now be satisfied without any difficulty at all. Where the old engines used to shake themselves to pieces, and one had to send a man in a cart after them to pick up the bits that they shed, a modern engine, by a good maker, will run hundreds of miles without requiring even screwing up.

It is frequently objected that traction engines are unsuitable for transport service because they cannot deliver direct to the troops in camp. Whether they can or cannot is an open question, which we can waive for the present, but it would be as reasonable to refuse to avail oneself of the services of steamboats and railways because these also cannot deliver their contents by hand at the company kitchens.

For all practical men it should suffice that by the use of traction engines one can reduce the number of horses required for transport by four-fifths in round numbers, the length of the columns of route by three-quarters, and at need can increase the rapidity of delivery twice over, indeed even more. The need for potential mobility is not always sufficiently realised, but an example will make the matter clearer. According to Prince Hohenlohe (Letters on Artillery, Marches of

Columns, pages 215 to 220, English translation), the reserve ammunition columns of the Guard artillery marched from St. Privat back to Saarlouis and from Saarlouis to Sedan 230 English miles, in twelve days, and this he rightly characterises as an exceptional performance. Actually, under the conditions of roads and weather prevailing, modern engines could be guaranteed to do the distance in two days; and even allowing for blocks on the road, due to accumulations of trains, etc., four days should amply have sufficed, but in four days the Guards had only accomplished a fraction of their twelve days' march, and eighty miles at least must therefore be knocked off from their total; hence the reasonable chances are that the columns would have been back with their headquarters before the Meuse army had started on their westward march. As to the danger of conveying ammunition by traction engines, there is no greater risk when packed in lock-up wagons than in sending it by rail. A thousand other instances will occur to anyone who has studied the transport problem, and we would advise those interested in it to take this book in hand and apply the data therein contained to each problem as it is encountered.

With Wilson in Matabeleland.—By Captain C. H. W. DONOVAN, Army Service Corps. London: Henry & Co., St. Martin's Lane, 1894.

This book, though interesting, is somewhat disappointing. One takes it up hoping to find a detailed account of the experiences of a comrade of the gallant Wilson, but it is replaced with different feelings. It is divided into two parts, the first dealing with the sport afforded by the country, and the second giving the writer's experiences of the campaign. Captain Donovan in his sporting tour was fortunate in bagging a variety of small and big game, varying from crocodiles, lions, giraffes, hippopotami, elands, buffaloes, and various kinds of buck, to birds, hares, and fish. But he does not appear to have been accompanied by Major Wilson and therefore the title of the book is rather misleading. The second portion, treating of the campaign against the Matabeles, was published some months ago by Gale and Polden, in the form of a paper read by Captain Donovan before the Aldershot Military Society as long ago as 20th March last. This is decidedly the most interesting portion of the present publication, though the writer does not appear to have made the best of the materials which he evidently possessed for compiling an account of the operations which would be instructive to British officers. Maxim guns played the most important part in this little campaign, and the late Captain Lendy evidently worked hard in instructing his motley army in their use, though we gather that the shooting was a bit wild. The guns were dragged sometimes by horses and at others by oxen. The action on the Shangani River was commenced by an advance of the Matabeles in extended order, in which they took every advantage of the cover afforded by the bush. The Maxims on this occasion fired wildly at the flashes in the bush, though they did better execution in the subsequent three rushes made by the enemy, of whom some ten per cent. appear to have been killed or wounded. There was a large expenditure of ammunition, but unfortunately no statistics forthcoming as to the percentage of losses to shots fired. Details of this kind would have added immensely to the value of the book, without making it unnecessarily dry. However, it is very acceptable in its present form; but the title should be altered. There is very little mention of poor Wilson throughout the entire book.

Life in the Confederate Army, being the observations and experiences of an Alien in the South during the American Civil War. By WILLIAM WATSON. London, Chapman and Hall, 1887.

This book supplies a want which, we believe, has long been felt by students of the American War. Too many of the very voluminous works dealing with that great struggle are devoted to strategical disquisitions as to the conduct of the several Generals, treated on the lines of the pre-Napoleonic histories. In those

days the system of recruiting and conditions of service being everywhere much on a par, the only variable left to be dealt with was the ingenuity of the commander in devising traps and strategems. All other conditions being equal for both sides, the "dodgiest" man was the most successful, and hence obtained the greater glory, and to prove one's hero to be "dodgy" was to confer on him a higher distinction than to demonstrate his courage and strength of character. All this was changed, as Clausewitz long since showed, when the outbreak of the Revolution in France completely altered the conditions of modern warfare, and Napoleon, Wellington, and Blücher, with the troops they controlled, proved to the world that discipline, together with iron resolution, in all ranks, was of infinitely greater consequence than any mere "dodginess" on the part of the chief. The standpoint of military criticism has therefore shifted. What we seek to know now, in order to classify our heroes, is the true nature of the contending forces, the internal friction induced by defects in their organisation, the nature of the steps taken to obviate this friction, and the degree of success each leader achieved in inspiring his men with that *discipline of endurance*, both on the march and in the field, without which no great army can march or fight at all. For this kind of information, as a rule, we look in vain; battles are treated as the collision of so many units, more or less, but of the power that held them together, how it was taught and ultimately enforced; the spirit of the units themselves; all this is taken as a matter of common knowledge, unworthy the attention of a serious historian.

This is the want that this book supplies, and admirably. Without partiality, favour, or affection, and with great modesty—the author reveals to us the day-by-day life of the army as it actually was, telling us the privations, and how they were borne; of the difficulties and dangers, and how they were overcome. Given this information, and one can make some headway; the true secrets of success or defeat are revealed to one; and in proportion as the reader realises each situation, he will be in a better position to deal with a like one should the case ever present itself to him, and in so far he will be a better soldier. Let him spend twenty years if he likes in the study of the old type of military history, in which men are counted as pawns, and human nature is ignored, and though he may become an exceedingly useful ambulatory library of reference for other brains to pick, he will never by such study alone qualify himself to lead and command men.

General Lee, of the Confederate Army. By FITZHUGH LEE, his Nephew and Cavalry Commander. London: Chapman and Hall, Ltd., 1895.

"The history of the world is the history of its greatest men," and the history of a great war is best studied in the lives of those who led the armies. It must always be a matter of regret that Lee never carried out his intention of recording the deeds of that Army of Northern Virginia, which, under the control of his genius, won such imperishable fame. Had it not been for the great victories which that army won against such overwhelming odds, the American Civil War would have but little attraction for European readers. As it is, there are few who do not feel the fascination of that long story of heroic resistance and splendid patriotism, nowhere more graphically told than in the unassuming volume which lies before us. General Fitzhugh Lee has peculiar qualifications for the task. Not only was he near akin to the great commander, but he participated in his triumphs and disasters. From the Spring of 1862, when Lee first linked his fortunes with the Army of Northern Virginia, to the Spring of 1865, when 8 000 ragged and starving soldiers surrendered to Grant and Sheridan at Appomattox, the young cavalry soldier was present at almost every battle. Nor was this all. Despite his youth, his eminent qualifications gave him the command of an Army corps before the war terminated and, as he was one of the most popular, so he was known as one of the ablest soldiers in the Confederacy. His criticisms and comments are those of the utmost value, and several points on which there has been much dispute, notably the responsibility for the defeat at Gettysburg, should be finally settled by his authoritative remarks.

The book is well and clearly written, and, like Lord Wolseley's "Marlborough," is refreshingly instinct with the individuality of the writer. We can cordially recommend it as an accurate account of the Virginian Campaigns, and as the best memoir that has hitherto appeared of a very noble life.

Our Next War: In its Commercial Aspect: with some Account of the Premiums Paid at Lloyd's from 1805 to 1816. By J. T. DAWSON. London: Blades, East, and Blades, 1894. Limited edition of 500.

It is encouraging to read in this book, written by a civilian for civilians, a spirit of patriotic yearning for preparedness for war, which is too often absent from the money-making mind. The ordinary City man lives very much in the present; he reads very little of the past history of commercial dangers; he thinks very little beforehand of the effect of a war upon his own interests, and still less of its effect upon the interests of the community generally. It is refreshing to have a writer of experience, setting as the motto for his brother business men the words *our duty to-day*, to think out beforehand the probable effects of a possible naval war, and to devise means and methods for minimising its terrors to commerce.

The comparisons of the premiums paid at Lloyd's during the wars of the early days of the century with those paid in these piping times of peace, steam, and telegraph, are interesting more than instructive. The writer, we think, over-estimates the value of the war risk of to-day in under-estimating the greater facilities for and competition in the underwriting business.

Be this as it may, there is much force in the author's appeal to the naval authorities to undertake "the preparatory work before the war comes," "by selecting certain routes to be specially guarded and certain regulations to be observed in using these or other routes," in order that "the underwriters, knowing what may be expected, may protect themselves by stipulations framed accordingly," and so the dislocation of business arrangements on the outbreak of war may be reduced to a minimum.

The Russian Jews. By LEO ERRERA, with a prefatory note by THEODORE MOMMSEN. Translated from the French by BELLA LÖWY. London: David Nutt, 1894. Price, 3s. 6d.

This book deserves the careful attention of all interested in the fighting strength of the Russian Army, for reasons originally given by Napoleon, and steadily kept in remembrance by the German Staff. We have strong grounds for considering the statement of Jewish grievances it contains as exceedingly moderate in tone. The revival of the Armenian question just at this moment gives additional importance to M. Errera's work.

The Liberation of Bulgaria. War Notes in 1877, by WENTWORTH HUYSHE, late Correspondent of the *Times* (Soudan, 1885) and *New York Herald* (Bulgaria, 1877). London: Bliss, Sands, and Foster, 1894. Price, 6s.

An exceedingly interesting and readable book, deriving its chief military value from the confirmatory evidence it affords of the accuracy of Colonel Valentine Baker's well-known "War in Bulgaria." The most interesting part of the book deals with the fighting on the Lom, and the final battle of the 21st September; a little more precision and detail would have been acceptable, but we have enough to teach us the same sad lesson, so often written in letters of blood, that no gallantry on the part of the troops can avail where the staff are incapable of reinforcing the fighting line at the critical moment, and of timing flank movements to coincide with frontal attacks.

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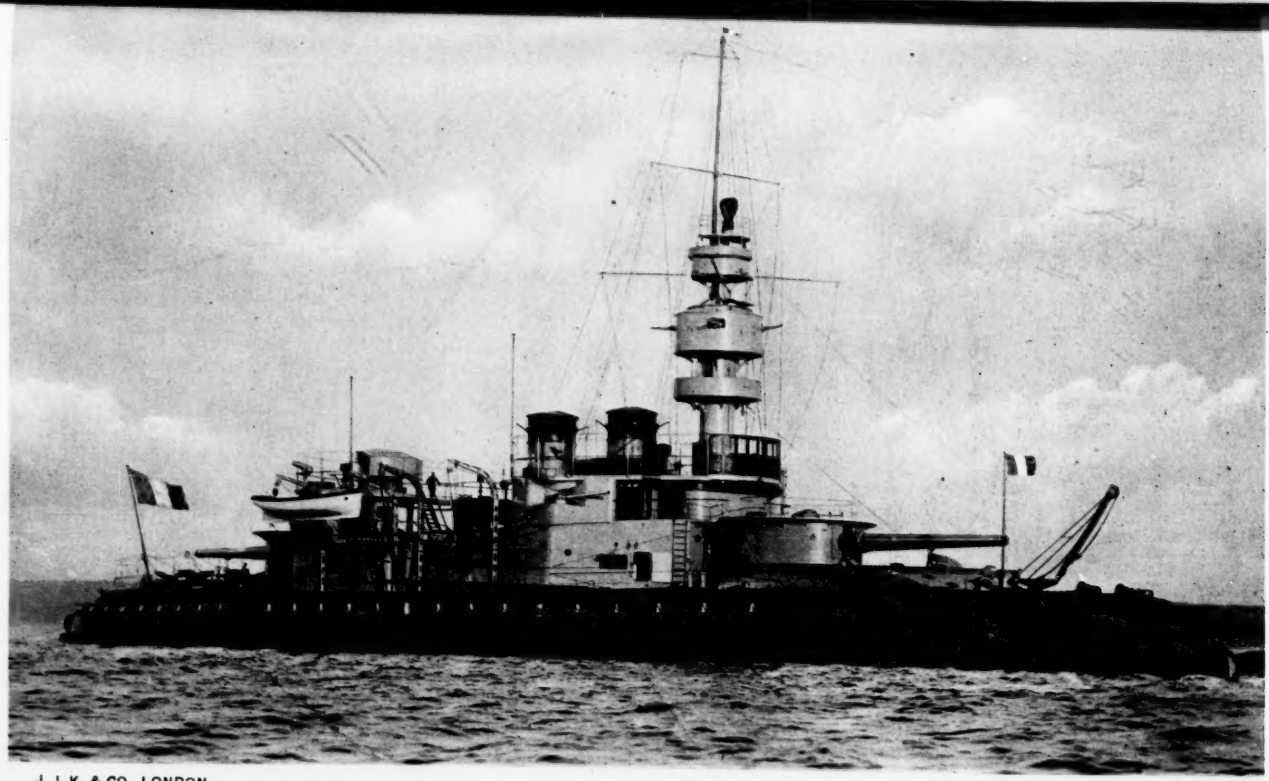

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